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The Society is not responsible, as a body, for the facts and opinions advanced in the papers published by it.

EDITORIAL

WHERE DOES THE FOREST SERVICE BELONG?

THIS perennial question bids fair to figure prominently in the discussion which will doubtless be aroused by the President's comments on reorganization of federal departments in his message to Congress. That the Forest Service is one of the bureaus which Mr. Hoover had in mind in referring to the fact that there are eight conservation agencies in five different departments can hardly be doubted.

In most of the arguments concerning federal organization it seems to be taken for granted that all of the agencies dealing with conservation should be in the same department. Whether this is sound policy doubtless depends in part, but only in part, on what is meant by "conservation." If the term is taken in its broad sense it includes practically every constructive governmental activity. Surely the Forest Service, the Bureau of Mines, the Bureau of Standards, the Children's Bureau, the Lighthouse Service, and the Public Health Service in endeavoring to promote the preservation and the wise use of natural and human resources have conservation as their object. Yet no one has yet suggested that they be combined into a single department.

Probably the more frequent use of the term is with reference to the conservation of natural resources only. Even in this restricted sense is it true, or is it even generally advocated, that all bureaus whose activities lie in this field should be in the same department? Certainly the most fundamental of our natural resources is the farm land of the country, yet one seldom or never hears the suggestion that if all conservation activities are to be centered they should be grouped around the Department of Agriculture. On the other hand it is frequently proposed to transfer the Forest Service out of the Department of Agriculture to the Department of the Interior, or to a proposed department of conservation or of public works, for the very reason that it is a conservation agency. "Trees may be a crop," wrote William Hard in an article entitled "Untangling the Government" in *The Nation's Business* for April, 1929, "but reserves of federal trees would seem to belong more properly to the field of federal conservation along with the General Land Office and the National Park Service."

Do not Mr. Hard's naïve doubts as to whether trees really are a crop and his citation of the General Land Office as a typical conservation bureau indicate a lack of understanding that is as deep-

seated as it is widespread? Forestry is looked upon as dealing more with utilization than production; national forests are still "reserves"; reservation is regarded as synonymous with conservation; and no distinction is made between different classes of natural resources. Any reorganization of departments based on such a confused and superficial point of view is apt to be worse than useless.

In deciding on the logical allocation of the Forest Service or any other governmental bureau the first step would seem to be to define clearly its primary function. This settled, its proper niche in the scheme of things is likely to be relatively obvious. The outstanding activity of the Forest Service, whether in handling the national forests or in promoting the practice of forestry by private owners, has to do with the production, utilization, and perpetuation of the plants and animals which compose the forest community. This activity necessarily involves engineering considerations, as in the surveying of boundaries and in the construction of roads, trails, and other improvements; it also involves economic considerations, since forest production and utilization is distinctly a business enterprise. The prominence of engineering and economics in forestry do not, however, in any way alter the fact that its most fundamental activities are biological in character. This will become increasingly evident with the disappearance of the virgin forests, the more intensive management of both public and private forests, and the replacement of timber mining by timber growing.

In a word, the main task of the Forest Service, in spite of Mr. Hard's skepticism, is crop production. This central fact clearly differentiates its activities from those of conservation agencies dealing primarily with mineral resources, such as the Geological Survey and the Bureau of Mines, or of those dealing primarily with engineering enterprises, such as the Reclamation Service and the Army Engineers. It is difficult to see any close affinity between the development of our mineral resources or the construction of purely engineering works, and the production of forest or other crops. To suggest the throwing together of these different agencies for administrative purposes merely because they deal with widely varying types of conservation is to imply a similarity in function which does not exist.

On the other hand, there is an essential unity about the raising of corn, wheat, cotton, trees, cows, sheep, and deer that is too obvious to require argument. Agriculture is the business of growing farm crops (both plant and animal), forestry that of growing forest crops. That forests, because of their longer life, must be handled differently in many ways from cereals, does not change the fact that their management is primarily a problem in biology; and the solution of biological problems, including of course their business aspects, is essentially the function of the Department of Agriculture.

History affords a strong argument for leaving the Forest Service where it is. Investigative activities in forestry have always been centered in the Department of Agriculture; and the present efficient management of the national forests was developed only after their transfer to that Department from the Interior Department. Differences in personnel and in point of view may explain in part their better handling by the Department of

Agriculture, but the basic reason for the success of the latter apparently lies in the union in a single bureau of all the forestry activities of the government, and in the close association of these with the other biological activities of the department. To leave undisturbed an arrangement that has actually worked in practice and that is wholly justified in theory would seem only common sense.

Clear-cut recognition of function, and association with other agencies performing similar functions, are the two primary criteria that should govern in any reorganization of federal departments. Judged by these criteria, the Department of Agriculture (or why not Agriculture and Forestry?) should handle all activities dealing essentially with the production and utilization of farm or forest crops. This would obviously include not only the management of the present national forests and other federally owned timberlands (with the possible exception of Indian lands, which because of the character of their ownership constitute a somewhat unique problem), but also the now unreserved public domain which is primarily valuable for grazing and watershed protection. There is no reason to tear the Forest Service from its natural associations in order to place it in a group of agencies with which it has little in common except that they too deal in part at least with conservation and with federal lands. "Conservation" constitutes a better shibboleth on which to base a national philosophy than an organization of government departments.

Confusion as to the place of the Forest Service arises because of confusion in the public mind as to what forestry itself means. We are still living too much in the pioneer period where forests are mined like coal or iron with little or no thought of their replacement. Foresters and timberland owners have no more important duty than to supplant this point of view by the timber growing point of view which recognizes forestry as a business, to be sure, but as a business based primarily on applied biology. When the true significance of forestry is generally understood, not only as a result of paper preaching but still more of actual practice in the woods, there will be no question as to where the Forest Service belongs.

SOME THOUGHTS ON THE FINANCIAL ASPECTS OF COMMERCIAL FORESTRY

By F. W. REED

Forester, National Lumber Manufacturers' Association

A SAWMILL as a means of *selling timber* is one thing. Timber as a means of providing raw material for a *manufacturing* enterprise is another thing. That the lumber industry will, as time goes on, become less and less a strictly sawmilling business and more and more a wood conversion or fabrication business is inevitable. We are in fact in the midst now of exactly that transition.[1]

Industrial forestry is a problem in the profitable use of land through growing crops of merchantable timber upon it, rather than a problem in providing a supply of some particular kind or grade of sawlogs to some special type of manufacturing plant. The lumber manufacturer, as a rule, has acquired his timber holdings because they carry a stand of sawlogs of the kind that his present sawmill can use profitably as raw material. In figuring whether it would be profitable to hold his lands for new growth, and to modify his logging methods to encourage that new growth, he too often falls into the error of recognizing as merchantable only that particular kind or grade of sawlogs which he himself has been accustomed to use in his own mill.

A calculation on such a basis leads inevitably to the conclusion that one-crop forestry is as little likely to be profitable as is one-crop farming. One might with equal logic prove that farming is inevitably unprofitable because even on the richest of soil it is impossible to raise a crop of tenderloin steaks of sufficient quantity and within a short enough period to pay satisfactory dividends on the investment.

The successful farmer (and there are some, even in these parlous times) keeps his land continually producing every kind of crops which is adapted to it and which can be marketed profitably. The farm owner may at the same time be a successful manufacturer of textile goods, of flour, or of coughless cigarettes, but in planning the management of his farm he does not think solely in terms of the cotton, wheat, or tobacco which his particular manufacturing industry uses. By so doing he would simply be cramping his style as a farmer and lessen his chances for making his farm produce money.

By the same token the forest-owning lumber manufacturer when he comes to branch out into the business of forest growing needs to figure in terms not only of the sawlogs he has been used to, but also of any and all other forest products which may be grown on his lands. In other words, as a lumberman, the sawmill and the sawlogs it needs are his primary consideration; as a forest grower the forest land as a producer not only of sawlogs but also of every other conceivable kind of forest crop, is the most important item of consideration. The sawmill becomes an item of minor consideration and may eventually be junked

[1] From "'Wishbone' or 'Backbone' in the Lumber Business," by Wilson Compton.

to make room for some more efficient means for converting the raw wood grown in the forest into a marketable product.

One crop farming sometimes pays and occasionally it may prove profitable to grow sawlogs alone, but in either case diversification of crops will increase the chance of profit.

It is all very well to indulge in theoretical generalities, as above, but when the lumberman comes to the point of deciding what he shall do with the lands which he has acquired in the course of his business as a producer of lumber, whether he should sell his stump lands for farming, should abandon them as worthless, or can make money by holding them for the growth of a second crop of timber, he wants facts, definite facts, and a whole lot of them.

He wants to know how fast his land will grow timber, how many years it will take to mature a second crop, how big that second crop will be in terms of board feet, cordwood, telephone poles, ties, or what not, and what special measures in the way of fire protection, and modifying his cutting and logging methods, are necessary to insure the most rapid growth. To know how profitable the venture will be, it is of course important to reduce all these things to dollars and cents and to balance income against outgo. The profit from growing a crop of timber is what is left of the stumpage sale value after subtracting from it all the costs, viz: the accumulated interest on the initial investment in the land, the accumulated annual taxes, the accumulated annual fire protection and supervisory costs, and the cost of such silvicultural measures as may be necessary to put the crop in the best growing condition.

The cutting and logging methods in use on the property are presumably the most efficient and the cheapest to get the present mature crop from the woods to the mill. If, for the sake of the new crop, it is necessary to introduce selective cutting in order to leave more of the younger and thriftier trees for future growth, or to replace power skidding with animal logging in order to avoid injury to the young timber, the result almost inevitably is an increased cost per 1000 board feet of getting the present crop to the mill. This increased cost is properly chargeable to the cost of growing the second crop. It goes without saying that the cost of removing weed trees to make room for restocking with the profitable kinds of timber, the replanting of the cut-over land with nursery-raised seedlings, and similar silvicultural practices, if they are used, are also directly chargeable against the new crop.

Since a number of years is required for a timber crop to reach maturity, since there may often be a period of years during which no income is received, while at the same time there are annual expenditures to meet the annual cash costs of fire protection, taxes, and interest payments, the element of compound interest enters into the calculation.

There are forest economists who have argued that the compounding of interest in forest finance is not necessary. They must thereby have grievously strained their backs and their mentalities, because the fact remains that if one borrows $100 from his bank and agrees to pay 6 per cent interest, if at the end of the year he is unable to take up the note

or pay the interest thereon, but if, by the grace of God, the bank is willing to extend his credit for another year, he must at the end of the second year be ready to pay back to the bank not only the original loan of $100 plus two year's interest, but also one year's interest on $6. He owes the bank not $112 but $112.36. In short, because he has deferred the payment of interest, he must pay compound interest on his original $100 loan.

On the other hand, if he carries a savings account with the bank, if he becomes the lender and the bank the borrower, the latter agrees to pay him interest not only on his actual deposits, but also interest on the accumulated interest. The bank pays him compound interest on his loan. Some banks even offer to compound the interest semi-annually.

Since in other financial transactions it is the rule to compound the interest on deferred payments there seems to be no sound reason for making an exception in the case of forest finance.

It is unfortunately true that an investment, or a loan, at compound interest, accumulates over an extended period far too rapidly for the peace of the debtor's soul (if he has a soul). This the bank recognizes by refusing to extend credit on deferred interest payments over too long a period, and, as a borrower, by not allowing a savings account to accumulate beyond a certain maximum.

Fortunately in a forest-growing venture it is rarely necessary to let deferred payments, or annual expenditures, accumulate at compound interest over the full period required for the maturity of the final crop. This is a point which those who think only in terms of old-growth sawlogs of great size and great age make the serious error of overlooking.

As the crop grows it is often practicable to make thinnings or improvement cuttings which will raise its quality and rate of growth because the products ot such cuttings have a sale value in the shape of pulpwood, fence posts, ties, or such like. Where intermediate revenues can be derived by such means they serve to offset, partially, if not wholly, the annual carrying charges of interest, protection, and taxes and to prevent them from compounding too long. In the slash pine and longleaf pine country it has been found practicable to start turpentine operations at an early age and from then on to produce an annual revenue while the crop is growing to maturity.

All in all, a financial calculation to determine the possibilities of profit from forest growing under a given set of conditions becomes, if one is not careful, an awesomely complicated problem in higher mathematics. There are textbooks which instruct one how to do this with a nicety of detail and which provide the formidable formulæ (similar in appearance to a druggist's prescription, only more so) by which the numerous items of cost may be properly balanced against the various revenues with due regard to the time element involved, and the whole mixture seasoned to exactly the right degree with the condiment of compound interest.

Undoubtedly it is good mental training for the forest school student to learn how to work out these formulæ and algebraic equations and to understand the fundamental scientific principles of long time financing. It is extremely doubtful, however, if by this means practical

conclusions can be reached as to the possibility of profit in growing a crop of timber.

A chain, it is commonly understood, is no stronger than its weakest link, and mathematical computations of this sort are full of weak links in the long chain of inaccurate and unreliable factors we must put into them. We may know that the land has produced one valuable crop of timber and therefore believe that it will do so again. We may even feel confident, with our increasing knowledge of the art of making more and better trees grow faster, that we can make the same land produce a second larger and better crop within a shorter interval of time, at a compartively moderate cost. But what the new crop will be worth when it attains maturity some 30, 20, or even 10 years hence, and what, therefore, the exact profit will be from the undertaking, we are unable to forecast with any degree of certainty. Markets, manufacturing, and methods of use of forest products are changing so rapidly that timber of a given kind, quality, and quantity, by the time the second crop is grown, may have an entirely different value for an entirely different purpose from what it has today. About all we can be sure of is that the supply of good timber is steadily decreasing, that the demand for it is not decreasing, but as the National Lumber Trade Extension program gains headway will undoubtedly increase, and that therefore anyone who owns a stand of good timber a generation hence will find a ready market for it at probably better than the present values. If he can keep his growing costs within reasonable limits there would seem to be sufficient promise of profit to justify a venture in lumber growing, and there would be no incentive to engage in a long-drawn-out laboriously painful, mathematical calculation, observing meticulously the fine, scientific principles of long-term finance, and leading him in the end to nothing better than a guess.

Possibly as skill in the art of forest growing approaches perfection and we are able to forecast with certainty just what is the growing capacity of a given type of forest soil it may prove practicable to adopt some more or less simple rule-of-thumb as a guide in determining the possibility of profit. If, for example, the growing capacity is 500 board feet per acre per year, when fully stocked and properly cared for, and the investment value of the land is not more than $5 per acre, and the carrying costs of fire protection and taxes do not exceed 20 cents per acre per year, perhaps we can say that the business of timber-growing is assured of a profit. If the annual growth is less, say 300 board feet per acre, perhaps we can still justify the raising of a timber crop provided the initial cost of the land is correspondingly less, say $3 per acre, or the tax and protection costs can be cut down two-fifths. At some point, probably somewhere between 200 and 100 feet, the rate of growth is too small to promise a profit under any circumstances, and the land as a basis for industrial forestry is worth nothing at all, no matter how low the taxes or how cheaply it may be protected from fire. One of the most important problems in forest finance is to determine what this minimum limit of profitable productivity is.

There is one extreme school of thought which seems to hold that all forest lands will grow timber profitably, because it advocates mandatory legislation which

would force every forest owner to practice forestry. There is a second school which, since it advocates wholesale Government forest ownership, or at least heavy Government subsidy, apparently holds to the view that no forest land will grow timber profitably. Both schools are about half right and about half wrong, as the prevailing majority of experienced foresters know. But even this prevailing majority cannot as yet place its finger on the definite dividing line between profitable and unprofitable forest land.

Even though the land may be capable of producing a maximum crop of timber in a minimum length of time and a correspondingly large revenue is in prospect, satisfactory profit is possible only if costs are kept within proper limits. This point is well recognized in the voluminous flood of discussion covering forest taxation, fire risk, and ways and means of reducing the burden of both. One of the most important elements of cost is the investment value, or initial purchase price, of the land itself—not the timber or young growth on the land, but the soil itself. The more one pays for the land the higher his annual interest charges will be and the less chance there is for keeping the tax rate down.

More than one fertile farm has proved a business failure because the owner paid too much for it and the interest on his mortgage ate up too much of his income.

An otherwise profitable forest-growing venture can easily be ruined in the same way. There has been an unfortunate tendency, which still persists in some sections, in appraising the forest-growing value, to be unduly influenced by agricultural values. Not so long ago it was the common dream of the lumberman that agriculture would follow close upon the heels of his logging operations and that he would be able to sell his stump lands to the honest farmers for $10, $25, or more per acre.

He has been inclined to value them accordingly, and the wide-awake country official has been equally ready to assess and tax them on the same basis.

If the land will grow timber at the rate of 500 to 1000 board feet per year, a skillful mathematician, by manipulation of the forest finance formulæ referered to above, can easily prove an investment value of $10, $25, or more. By so doing he will be guilty of the same breach of ethics as the high-pressure realtor when he talks the city sucker into paying $1000 per acre for an orange grove on the theory that there will be a bumper crop of fruit each year which can be sold at top prices, and no risks involved.

Fortunately the price of land in the long run is regulated by the law of supply and demand rather than theoretical financial computations. As we get further away from war-time boom conditions we are seeing more clearly that the supply of land far exceeds the demand and its value therefore is fixed by the pressure to sell rather than the desire to buy, and not at all by its theoretical producing capacity.

The acreage under cultivation is decreasing through the well-recognized progressive abandonment of improved farms of the marginal class, and the acreage of potential forest land is thereby increasing. Some lumber companies have found so little market for their cut-over lands that they can reckon them into a forest growing venture at practically a zero capitalized valuation with no inter-

est charges, and the initial investment is then limited to the cost of planting or of other silvicultural measures to restock it, such as the leaving of seed trees or of small growth from the old stand.

To prove in another way that forest land, as forest land, has only a nominal market value, one need only consider the prices at which land carrying a stand of merchantable timber can be bought. Almost invariably he will find that the price covers only the value of the timber and the land is thrown in for good measure.

If forest land, without merchantable timber or promising young growth upon it, sells for more than $5 per acre, one may be sure that there are other values involved such as speculative mineral possibilities, use for a game preserve, or proximity to a growing urban center which offers prospect of subdividing some small portion of it into building lots.

COMMENT[1]

By H. H. CHAPMAN

Professor of Forest Management, Yale School of Forestry

I have no quarrel with your article. The mistake that you fellows make in decrying compound interest calculations on the basis of uncertainty, is in not recognizing that they are frankly intended in every case as personal estimates or appraisals of probable future value or profits. In this they differ not one whit from similar estimates made in every other line of business, and no business man expects such estimates to pan out because he knows that he cannot tell what the future market price will be.

No guess can even be made towards approximating the price of bare land or costs which would be profitable without such appraisals. The insurance business constantly uses much worse formulæ than foresters ever dreamed of.

The second point is the utter neglect of the "continuous business" phase of reinvesting income to secure continuous output—which completely alters the psychology of the investor regardless of the mathematics of compound interest. A concern as long as it has income will pay out taxes on cut-over lands. Not so when this must be taken from capital. Yet mathematically these two cases are exactly equivalent. You cannot substitute the stand, or crop unit, for the business unit when dealing with the business of a going concern. If you could, all western firms would go bankrupt tomorrow from the evident impossibility of making profit on stumpage against which all prorated carrying charges are placed.

There is one point in your paper worth discussion. At Crossett, Arkansas (according to L. R. Wilcoxon in the May, 1929, Forest Worker), the leaving of young trees and use of teams, especially the former, has reduced the cost of logging, increased the value per thousand of the lumber, and materially increased the profits. This difference or saving by your logic should be credited to the operation of reforestation, serving to offset that sum in costs of planting, fire protection, taxes, etc. But what is sauce for the gosling often looks like apple sauce to the gander. Moral, lack of propagander.

[1] Contained in a letter of August 3, 1929, to the author.

FORESTRY IN NEW ENGLAND[1]

By HENRY S. GRAVES
Dean, Yale School of Forestry

FORESTRY in the United States is emerging from the pioneer stage. The first task has been to educate the public to the necessity for a better handling of the forest resources, to inaugurate a system of fire protection, to initiate a policy of public forests, and to provide other features essential in laying the foundations for forestry practice. We have already progressed so far that, in some sections of the country, the management of land with a view to continuous forest production is actually under way. This applies to the public forest reservations and to an increasing number of private properties. In making this statement I do not overlook the fact that generally speaking private forestry is very backward and that some regions are still in the pioneer stage with a vast extent of land without even a semblance of protection from fire. Enough is being done, however, to demonstrate that forestry today is feasible and that in most sections it is possible in practice to make provision for forest perpetuation at the time of cutting the mature timber.

The conditions for forestry practice are peculiarly favorable in New England and in the adjacent regions. Generally speaking more intensive forestry can be carried on in the Northeast than in other parts of the country. In the first place it is a humid region, with conditions for fire protection so favorable that the fire hazard has been greatly reduced in recent years and should in a short time be largely eliminated. The proximity to a great center of population offers advantageous markets for diversified products. The excellent system of highways favors the application of good methods of forest management. The nearness of a large population offers opportunities for subsidiary uses of the forests, as for example in meeting the demands for public recreation in its various phases. Though the problem of forest taxation has not yet been solved; public opinion is ripe for definite steps to modify the present system, which acts in many instances as an obstacle to the practice of forestry on private lands.

The part that forests may play in the permanent well-being of New England is not generally realized. If it were, our legislatures would be more alive to the situation and more ready to support the measures essential in advancing forestry. Our people do not worry much about the question of a lumber supply. Great quantities of material of prime quality are coming into the local markets from the South and West, and at prices which compete with the timber produced in this region. Substitutes are now available for many purposes for which wood was formerly used. There is plenty of forest land in New England which has a higher percentage of its land area in forest than any other group of states. There are

[1] Presented at the Third New England Forestry Congress, Hartford, Conn., Feb. 1, 1929.

manifold activities in forestry in New England. Each state has established a central forest organization; there are six collegiate institutions teaching forestry; there is a splendid National Forest and in several states numerous state forests; there are five state forestry associations, and many trained foresters, all very active in promoting forestry.

In view of what today is being accomplished, is there reason for any anxiety about forestry in New England? Should I not rather in this paper enumerate the long list of very real achievements and the excellent work of those who are responsible for them? It is difficult for me not to follow this course, for I began my work in this region over 35 years ago and I have a vivid appreciation of the contrast between the forestry situation then and now. But the question in which I am interested is not whether a considerable amount of good work in forestry is being done or whether New England is better off than some other regions of the country. It is whether the forests are being handled as well as they may be under our present conditions, with the end in view that they may render a maximum service to their owners and to the economic welfare of the region.

It is of the utmost importance in considering the problems of forestry in any given region to understand clearly the purposes served by a better handling of the forests. The objective most commonly stressed is to provide as large an amount of lumber and other wood products as possible for industrial and other use. General statements are commonly made showing that over half of the lumber used in New England is brought in from other sections, chiefly the South and far West, that our annual freight bill is about $13,000,000, and that by better forest management we may in the long run furnish from our own forests a much larger proportion of the needs of the region, with a material financial saving and presumably greater convenience to the user.

This is a very important objective, but it has not been particularly convincing to the public and to the legislators who are asked for appropriations to forward the practice of forestry. The New England forests have been so depleted of their timber of high quality that the industries cannot obtain locally what they need. About 70 per cent of the lumber consumption of New England is in Massachusetts, Connecticut and Rhode Island. These are industrial states. Like all industrial centers they are unable to supply their needs of lumber from home resources, and never will be able to do so. A great deal of what they use could not be produced locally in any case because of the specialized character of the demands. New England must be served largely by the general market in which all classes of timber products are available. If on account of the progressive depletion of forests elsewhere the price of imported lumber increases, the price of native lumber is likely to increase also; and there is always the chance that some substitute can be found for a particular purpose for which wood has heretofore been used. This is about the reasoning, no matter what its fallacies, that prevents many persons from relating the general lumber supply question in industrial New England to the problem of forestry on its own lands.

The forestry question assumes greater importance, however, when one considers

the relation of the forests to the building up and sustaining of local industries. I do not need to dwell on the great value of having manufacturing industries well distributed throughout a given region, and particularly in the rural districts. In former days many wood-manufacturing plants were widely distributed in the different towns and communities. Some of these assumed large proportions; others were small concerns employing only a few men. In all instances they furnished an industrial vitality to the communities, which always adds to local pride and efficiency. The depletion of the timber and other causes have led to a progressive shrinkage in the number of these plants.

In the northern part of New England there are still many industrial plants which depend on local forests for their continued existence. We are proud of the great pulp and paper plants and specialized wood-using industries that are vitally important elements in the economic prosperity of several of our states and of the region as a whole. The problem of their continuance and of the restoration of wood manufacturing plants at points in the forest sections where they have disappeared is one that should command the earnest consideration of every one who has the permanent welfare of New England at heart.

Closely associated with the foregoing problem is the relation of well-handled forests to agriculture. The settlement of New England in the early days was directed primarily to the occupancy of the land for farming and stock raising. This was not confined to the valleys where most of the land was of agricultural character. Settlements and farms were established in the sections where the productive lands were intermingled with areas of little or no value for farming. Many areas were cleared which proved to be in the marginal zone or to be only valuable for forest production. But there were many tracts brought under improvement that have excellent soil, though in small units. In former days the forest was a vital factor in making farming possible under such conditions. Part time work in the woods with men and teams, opportunities for occasional employment at the local mill or factory, and the sale of material from the farm woodlot, in many cases added 30 to 40 per cent to the farmers' income.

We are all familiar with the breakdown of agriculture in the lean-land sections of New England. Between 1880 and 1920 the area of improved land was reduced by about 7,000,000 acres. Forest depletion was not the primary cause of this process, but it was an important contributory cause. The restoration of productive forests will be one of the instruments in the rehabilitation of rural New England. Recreation values of the forest are already playing a part in the occupancy of abandoned areas and restoring prosperity to rural communities. The revival of forest activities and restoration of local wood-manufacturing plants will react to make possible many agricultural undertakings that have been abandoned.

New England has a land problem of capital importance. Industrial development, increasingly centered in urban districts, has overshadowed the rural problems, particularly outside the rich agricultural regions. In the three northern states over 70 per cent of the land falls in the class of forest. In Massachusetts 49 per cent of the land is forest, in Con-

necticut 51 per cent, and in Rhode Island 41 per cent. This large area of land ought to be a great asset to the states and to the region as a whole. The forest lands of New England today are rendering only a small fraction of the service that is possible. Many industrial plants are still drawing on old timber, which we loosely designate as virgin forests. These are localized in northern New England. Elsewhere the merchantable timber has been in large part removed and that which is standing today is in scattered patches often so situated that it cannot be operated to advantage.

In a considerable part of New England the forests have been cut over a number of times and the present forests represent the volunteer growth after cutting or fire, or the natural regrowth upon abandoned fields. Very little of this so-called second growth is the result of conscious effort to secure reproduction of value. Nature tends to reclothe cleared lands with vegetation of some sort. Even after a destructive fire, a growth of trees is eventually established provided the soil has not been washed away. But the character of the new vegetation depends on a variety of conditions, such as the distribution of seed, the receptivity of the soil, seasonal conditions following the removal or destruction of the forest, the competition between various plant species, and other factors.

From a practical standpoint it is desirable to know whether the new stands are well stocked with species that have some prospective value. As a rule the reëstablishment of forest stands of good quality is a very slow process where no definite effort to aid nature is made. It is true that sometimes, especially in virgin forests, a single clearing of the forest is followed by an excellent second growth. This is generally where a large amount of small seedling growth is already on the ground; and occasionally good reseeding results on clearings where seed trees are left standing on or near the area. As a rule, however, the new stand of trees after haphazard cutting is inferior, and it takes several tree generations for nature unaided to restore a forest of good quality.

The repeated cuttings to which the forests over a large part of New England have been subjected have resulted in progressive deterioration. In many cases the proportion of the less valuable species has increased, the density of stocking is deficient, large numbers of the trees are of poor form, and the total growth and yield from the standpoint of quantity and of quality production is far below that represented by the capacity of the land.

Abuse of the forest and haphazard cutting will not be followed by good forest growth. By skillful cuttings and subsequent improvement work forests may be replaced through natural seeding by stands of high productiveness. It is only occasionally and under special conditions that this can be accomplished under the current methods of operation. There is a saying that if fires are kept out of the woods nature will provide for reproduction. Some have said that fire protection constitutes 85 per cent of forestry. The implication is that, if forests are protected from fire, forest production may be obtained in the measure of 85 per cent of what is desirable. This is far from the truth and is very misleading. Fire protection is of course absolutely necessary as a foundation of forestry practice. But without additional mea-

sures nature will not, within any time that is of interest to us, provide a succession of the species we specially desire, with a density of stocking essential for production of material of good quality.

The idea is still prevalent that forestry begins after a forest stand has been destroyed. This is natural because there has been such extensive destruction of forests that the country is faced with a gigantic task of forest reconstruction. Reforestation, as the term is commonly used, has been forced on us by destructive abuse of the forest. Forestry is much broader in conception. It comprises the whole management of forests, with a view to the utilization of the timber and other resources, and the continuance of forest production. The cutting of timber is carried on in a way to secure natural reproduction. Maintenance of production is secured in the very process of utilization. This is very different from wrecking the forest and then making large investments to restore what unnecessarily has been injured or destroyed.

New England faces two problems in forestry. The first is to bring about a management of the matured timber that will provide for forest replacement of material of good quality and thus sustain the productivity of the land and its value and service. The other problem relates to the younger forests which, from the standpoint of productivity and prospective value, represent varying degrees of deterioration. In many if not most cases there is no opportunity for planting. The ground is already stocked with an inferior stand of trees. It is the custom to let these areas stand without attention until the trees are large enough for use. Then begins the process of further abuse and deterioration. What we are seeking in forestry is to do improvement work in these young stands in order to increase the quantity and quality of growth, so that when the trees grow to usable size the owner may secure a greater return; and then when the cuttings of merchantable timber are made, the following crop may have a character and promise far greater than that with which we have to work today.

In different words, the foregoing means that the time has arrived when forestry in the woods ought to be introduced very generally in New England. But forestry practice is not general today. It is no answer to say that we have a large amount of land covered with second growth and that we are not actually devastating our forests. While the growth in cubic feet of wood over all New England is large in the aggregate, though far less than might be, much of it is calculated to yield material of low grade. In central and southern New England we are raising fuelwood in large quantities, very likely more than can be absorbed when it is large enough to cut, but not much timber of good quality. Many people are going to be disappointed when they learn that they have been carrying for a long time low-producing tracts of land. It will be disconcerting to some large owners later on to discover that they have been eating into their forest capital and that their land assets have shrunk in value because they did not take the trouble to see to it that wholly practical measures for keeping up forest growth were taken. And the public will wake up to the fact that through their indifference a great renewable resource has ceased to serve in sus-

taining important manufacturing industries.

In urging that New England can do what is not being done in the way of actual forest practice, I do not overlook economic difficulties that are faced by the landowner. I appreciate as well as any one that certain economic obstacles must be overcome before a specified owner will invest any effort or money in forestry. Some of these can be removed. The first is the hazard from fire. Serious loss by fire is really unnecessary in New England. It is squarely up to the public to demand such support from the legislatures as will make our forests safe. There must be enough resources each year to enable the state fire protective organizations to prevent fires both under normal conditions and in seasonal emergencies. If present practices in logging create hazards beyond the control of an efficient fire service, these conditions must be ameliorated, if necessary, through further regulatory measures prohibiting the creation of such hazards. It is certainly disconcerting to learn that in 1927 nearly 90,000 acres of forests were burned in New England, doing a damage of nearly $750,000.

The present system of forest taxation operates today as an economic obstacle. This system can be modified if the people wish it. It is an unnecessary obstacle operating against the making of about three-quarters of the land of New England render a great and lasting service to the people of the several states.

Assuming that we can remove these two obstacles—and certainly the people of the New England States have the intelligence, courage, and resources to do so—how can constructive measures be brought into practice in the woods to replace the present process of attrition through destructive methods of woods operations? For one thing we must have more public demonstrations of the practice of forestry. A great many owners are skeptical whether anything can be done in practice different from the traditional pioneer methods of exploitation. They want to be shown by illustrations in the forest. Herein lies one of the most important functions of a public forest. Federal and state forests render a great service for recreation, watershed protection, and production of timber of good quality, but they should also provide illustrations of what forestry is, what it costs, and what results may be obtained through skillful handling of forest lands.

There should, in my opinion, be a much larger and broader program of public forests in New England. By a broader program I mean one that has in view something beyond the acquisition of cut-over land where the forest must be rehabilitated and where it will be years before the application of forestry to merchantable timber lands can be demonstrated. The public should support the acquisition of lands with grown timber as well as areas on which the forest has been destroyed; at least such lands should be secured to the extent necessary to make the public properties serve as demonstration grounds for the advancement of private forestry in the regions where they are located. The value of such demonstrations has already been proved through the work on the White Mountain National Forest, on the Harvard and the Yale forests, and on other tracts where real forestry is being practiced.

No nation or state can afford to permit a great natural resource like the forest to be dissipated. This does not mean that the timber should not be utilized. On the contrary it is through the use of the timber that most forests render their chief service. But we have to do with a renewable resource which need not be dissipated if provision is made for its continuance.

I have already indicated several specific ways in which public action is essential in bringing about a constructive handling of forests, namely, liberal support of fire protection, reform of forest taxation, a system of public forests where the private owner can learn what measures should, and in practice can, be used in keeping his lands productive, and provision for public educational work. Such action, involving as it does public expenditures, has for its object the economic and other benefits that will be derived from having a large part of New England's land in a productive condition. Private landowners receive a direct benefit. The public seeks to aid in making it possible for them through their own efforts to employ constructive methods of forestry. The public should lend every possible effort to aid the private owner in his problem and should be sympathetic with the practical difficulties which he encounters. At the same time the public may and will expect private owners to adopt the measures of applied forestry that are practical and really effective. Most private owners today are not doing what is entirely feasible in the way of forestry. On the other hand the public is failing to do its part in this great enterprise, and for this failure there is little or no excuse. When the public fulfills its definite obligations, it may expect the private owners genuinely to undertake forestry practice. And I am confident that when the general public is prepared to redeem its own responsibilities in working out a program of forestry, it will insist upon the private owners doing their part, employing, if necessary, regulatory legislation.

UTILIZING SOUTHERN NEW ENGLAND'S LOW GRADE FOREST PRODUCTS[1]

By AUSTIN F. HAWES
State Forester of Connecticut

Forest Inventory

In any marketing discussion the first thing to be considered is what we have to market. Beyond the fact that there are approximately 25,000,000 acres of forest land in New England, we have little detailed information as to just what is on this land. The Capper report made to Congress eight years ago estimated the amount of timber in New England at that time at 49,799,000,000 board feet of which 77 per cent was softwoods and 23 per cent hardwoods. This was a very rough estimate made by the writer after consulting the state foresters and other authorities in the various states. So far as I know, New Hampshire, Massachusetts,[2] and Connecticut are the only New England states which have made any systematic canvass of their timber resources. In a bulletin published in 1923 entitled Forest Resources of New Hampshire, the total timber supply of the state is estimated at 7,319,702,000 board feet, distributed as follows: pine 30 per cent; spruce and other softwoods 33 per cent; hardwoods 37 per cent.

In 1915 the Connecticut Agricultural Experiment Station published a report by Mr. A. E. Moss which showed that 46.4 per cent of the total area of the state was forest. In order to get information on the tendencies of land utilization for the past 14 years, the Connecticut Forest Service conducted a survey of two forest regions in the summer of 1928. This was made by two men in a car traversing all passable roads and plotting the forest cover on the topographic sheets. The cost of this survey amounted to $2.50 per 1000 acres covered. Four townships were covered in the first area and seven in the second. Besides these, somewhat more hasty surveys were made of all towns in Fairfield County, four in New Haven County, and eight in Middlesex County. Altogether 46 of 165 towns in the state were covered in this recent survey. Applying the figures so obtained and making due allowance for certain agricultural or urban towns, this survey indicates that 49 per cent of the total area of the state is now wooded, instead of 46.4 per cent as 14 years ago.

FOREST TYPES IN CONNECTICUT

A survey made in 1908 indicated that the mixed hardwood type comprised 79 per cent of the forest area in Litchfield County and 75 per cent in New Haven County. The abandoned field type accounted for 20 per cent in Litchfield County and 23 per cent in New Haven County. This left 1 per cent of the former and 2 per cent of the latter in the

[1] Presented at the meeting of the New England Section, Society of American Foresters, Hartford, Conn., January 31, 1929.

[2] Cook, H. O. A forest survey of Massachusetts. Jour. For. 27: 518-522. 1929.

softwood type. In the survey of 1928 a softwood-hardwood type was distinguished where softwoods compose from 20 to 80 per cent of the stand. Some of the land formerly classed as abandoned field has developed into this type. In addition to the 11 townships several state forests have been classified by types and the percentages with certain modifications have been applied to the whole state in making Table 1.

TABLE 1

DISTRIBUTION OF FOREST TYPES, CONNECTICUT, 1928

Type	Acres	Per cent
Mixed Hardwoods	1,193,333	75
Softwood-Hardwoods	151,477	10
Softwoods (over 80 per cent)	22,523	1
Abandoned Field	222,221	14
	1,589,554	100

AGE CLASSES IN CONNECTICUT

From colonial times Connecticut woodlands have been managed under a system of clear cutting, in the early days under a short rotation for cordwood, more recently under a longer rotation. The result is that our forests are fairly even aged. We have distinguished three age classes to correspond fairly well with the product:

Sapling stage, 1 to 20 years (trees under 5″ in diameter).

Cordwood stage, 20 to 60 years.

Timber stage, 60 years and over.

Table 2 gives the distribution of age classes in Connecticut in 1928 as determined from the survey of 11 townships and four state forests.

STAND OF LUMBER AND WOOD IN CONNECTICUT

A detailed estimate by the strip system has been made of four of our state forests aggregating 15,000 acres. A 12 per cent cruise was made of these tracts measuring trees down to 5 inches in diameter. In working up the results trees 5, 6, and 7 inches were classed as cordwood; trees 8, 9, 10, and 11 inches as small lumber; and trees 12 inches and over as merchantable lumber. When these average stands in the state forests were applied to the main types throughout the state, the results were too high because the state forests have been freer from forest fires and some other forms of damage than the state as a whole. A deduction of 20 per cent was made for damage from fire, ice, insects, disease and other defects. After making these reductions the total stand in 1928 is estimated as follows:

Merchantable lumber	1,015,580,000 bd. ft.
Small lumber	1,041,109,000 bd. ft.
Additional wood .	8,861,000 cords

TABLE 2

DISTRIBUTION OF AGE CLASSES IN CONNECTICUT, 1928

Type	Sapling stage		Cordwood stage		Timber stage	
	Acres	Per cent	Acres	Per cent	Acres	Per cent
Mixed Hardwood	411,405	34	620,632	52	161,296	14
Softwood-Hardwood	21,797	14	97,940	65	31,740	21
Softwoods	11,109	49	5,458	24	5,956	27
Abandoned Field	41,557	19	166,938	75	13,728	6
	485,868	30	890,968	56	212,720	14

Of this hardwoods comprise 83 per cent and softwoods (pine and hemlock) 17 per cent.

From these figures it appears that the total stand of merchantable lumber in Connecticut is about one billion board feet as compared to seven billion in New Hampshire. Another way of expressing it is that there is about half as much merchantable timber standing today as has been cut during the past quarter century, and just about enough to last another quarter century at the present reduced rate of cutting, without taking growth into consideration.

GROWTH OF CONNECTICUT FORESTS

In formulating a policy for the future, growth must be taken into consideration. From borings made on 1052 trees in all types and age classes, selected in a mathematical way, it has been possible to compute the amount of lumber and cordwood which we should have ten years hence, barring cutting, fire, and other damage. By deducting the present stand and dividing by ten we arrive at the following gross annual growth:

Growth	Board ft.	Additional cords	Total cords
Total	124,094,000	505,500	753,688
Per acre	78	.32	.41

It is probable that Connecticut's cut has reached its low-water mark, and that within a decade we shall see a slight increase. Before this comes about, we must try to bring about an adjustment between annual growth and annual cut.

Lumber Production

Lumber production in southern New England has been on the decline for twenty years. This is undoubtedly due largely to the death and removal of the chestnut, although it is interesting to note that the same thing is true of New Hampshire, where increased use for pulp has been a potent factor in the decline of the lumber business. In both New Hampshire and Connecticut the production of lumber increased rapidly between 1890 and 1908 or 1909, and has since as rapidly declined. In 1920 the production of lumber in both New Hampshire and Connecticut was exactly 27 per cent of what it has been at its maximum in 1909. Since 1920 the production in Connecticut has fallen to 24 per cent of its maximum.

It is perfectly evident that Connecticut, Massachusetts, and Rhode Island have been passing through a timber famine. If it were not for the supplies of virgin timber in the Northwest and Gulf States which are brought into Connecticut at an annual freight cost of $4,000,000, lumber would be a luxury beyond the reach of the average man. The disappearance of our timber supplies has been reflected in the number of lumbermen and sawmills doing business. In 1909 we had 1120 saw mills operating in these three states. In 1925 only 338 were left. The main product of these mills is railroad ties, for since the installation of a treating plant at North Haven, species such as birch, beech, and maple are usable for ties.

The Forester's Problem

The problem confronting the forester in southern New England is how to

improve the young stands, which are so numerous but so defective in saw timber. Much progress has been made in fire prevention. In Connecticut the area burned annually has been reduced from 3.5 per cent to 1.5 per cent. In the pine region landowners may be interested in such simple operations as weeding and pruning, but in a state like Connecticut where the occurrence of softwoods is confined to about 10 per cent of the wooded area, the difficulty in establishing silvicultural practice is very great. Only by numerous examples in the state forests can we hope for material progress along these lines. The need of thinning in the 17,000 acres of plantations which have been made in Connecticut will in a few years emphasize the importance of this kind of work in our natural stands.

There are few large lots of merchantable lumber left in southern New England (no virgin timber) and most of the lumber is of such inferior quality that it cannot be graded to advantage. Farmers and other woodland owners are at the mercy of portable mill men who will set up for 50,000 board feet or less, but insist on cutting everything in sight, regardless of whether it is profitable or not. The owner has no opportunity to practice the selection system in his older timber, or thinnings in his young stand, even if he were so inclined.

Permanent Industries Needed

The day of usefulness of the portable sawmill is past. What we need now are a few well-located permanent industries which would use different kinds and grades of wood. These would permit farmers to market a few trees at a time to advantage. The wood alcohol industry naturally suggests itself, but the profits from this have been much reduced since the war. The price paid for wood is low and the industry is only possible where cheap coal is available. Charcoal is used in considerable quantities in drying tobacco in the Connecticut valley, but this can be secured at a very low price from the distillation plants of Pennsylvania.

Dimension Stock

New England has many manufacturing industries which utilize wood in small pieces in the process of manufacture. For the most part they buy high-grade lumber from the South and saw it up into these small pieces, which could just as well be made from our small trees, if we had plants equipped for making this dimension stock. Portable mills are not so equipped, as dimension must be sawed true to size and must be properly seasoned. Slabs from logs sawed into ties are particularly adapted for this purpose since they contain clear lumber.

Of course, dimension stock may be made as the main product from small logs, or as a secondary product from large logs. So far as southern New England is concerned, our chief interest is in utilizing small logs. One conclusion reached by the U. S. Forest Products Laboratory is that small and inferior logs are fully as profitable for dimension stock, ties, and fuel as large high grade logs for lumber. The making of salable dimension stock undoubtedly requires considerable experience both in manufacture and salesmanship, but the necessary investment in a plant is not prohibitive.

PULP AND PAPER

Whatever may be the future of the dimension industry in southern New England, it will obviously rely largely upon the higher grade logs for its support. It does not furnish an outlet for thinnings which are so necessary to the practice of forestry. In a region with such a dense population utilizing immense amounts of paper, we naturally turn to paper making as a possible solution of the problem. But with 83 per cent of our timber composed of hardwood species, what can be done? Fortunately, hardwoods can be used for certain grades of paper. They are already being so used in Maine, Pennsylvania, and in southern mills, mostly in the soda process. A new semi-chemical process, already in use for container board, and under experimentation for other kinds of paper, makes it possible to get twice as much pulp from a cord of wood as by the straight chemical process. The cost per ton is lower than any other pulp produced excepting ground wood and would approximate $30 a ton. Our species suitable for pulp are beech, birch, maple, poplar, basswood, tulip, and gum. Further experiments may even demonstrate that oak can also be used.

It is estimated that a plant making 25 tons of pulp per day would be the minimum capacity that would pay. Such a plant would cost from $150,000 to $200,000 and would require about 9,000 cords a year. Undoubtedly a plant of double this size would be more economical and there are many sections in Massachusetts and Connecticut where an annual product of 18,000 cords of wood is obtainable within a hauling radius of 20 miles. Since pulpwood is worth from $10 to $15 a cord, there is sufficient margin to cover the cost and leave a fair profit.

COMBINED DIMENSION AND PULP MILL

A combined dimension and pulp mill would furnish a market to farmers and other landowners for all grades of forest products. There should be sufficient gradation in the prices to furnish an incentive to raise high grade materials. A company operating both mills could afford to do this, since the margin of profit would be greater on dimension stock sawed from good logs than from pulp; and the cost of making pulp from large bolts would be less than from small bolts.

INTRODUCING PACKING HOUSE METHODS INTO FOREST INDUSTRIES

The great difficulty with all forest industries throughout the country is the tremendous waste in the woods and at the plant. Sawmill operators leave a great deal in the woods in tops and defective logs, and the slabs are either wasted or used only for fuel. Pulp operators cause tremendous waste by cutting young growing trees, and by putting into pulp high-grade logs which should be used for a more valuable product. A combined dimension and pulp mill equipped with conveyors for handling slabs and mill waste would furnish the most profitable method of utilizing the products of our forests.

We hear so much about the shifting of industries from southern New England to states having the natural resources required by them, or cheaper power, that it seems strange business men have not considered wood an important

asset of the region. They probably still consider the forest from the viewpoint of the lumberman and feel that this asset is gone. When they come to realize that wood and small lumber are on the increase in southern New England, they will take a more progressive attitude toward utilizing these natural resources.

Francis Bacon in conceiving his Utopia 300 years ago had the governors engaged in such tasks as studying the stars, arranging to utilize for industry the power of falling water, developing gases for the cure of various ailments, experimenting on animals for surgical knowledge, growing new varieties of plants and animals for cross breeding, etc. The people of this imaginary island informed him: "We imitate the flights of birds; we have some degree of flying in the air. We have ships and boats for going under water."

Now that we too have "some degree of flying in the air, and have ships and boats for going under water and are utilizing for industry the power of falling water" in our own Utopia of southern New England, let us hope that we may also arrange to utilize wood for industry, as we did in the old days, and thereby add to this thickly populated region a natural and renewable resource, which has almost been forgotten by our industrial leaders.

INVENTORY OF NEW ENGLAND'S PUBLIC FORESTS AND PARKS[1]

By HARRIS A. REYNOLDS
Secretary, Massachusetts Forestry Association

PUBLIC open spaces for recreation are as essential to our modern civilization as a safety valve is to a boiler. The opportunities for outdoor exercise, pure air, and the change of scene afforded by such areas constitute one of the most important safeguards of the public health. The old town common was the first area of that type in this country and it was the forerunner of our modern park. For two and a half centuries the primeval forest was so readily accessible even to the city dweller that it was not until the early nineties of the past century that the public in New England began in earnest to recognize the need of acquiring open spaces for recreation and for the protection of natural scenery.

The early efforts in this field which laid the foundations for the remarkable progress of the past 40 years are of special interest. One of the prime movers in the drive for public action in the creation of such areas was the Appalachian Mountain Club, inspired and led by the late Charles Eliot, a son of the noted president of Harvard College. Largely through his efforts the Massachusetts Trustees of Public Reservations was incorporated in 1891 as a private society to acquire and hold lands for the benefit of the public. Its formation was one of the first systematic attempts made in this country to save our natural scenery from commercialism. The activities of that body and of other organizations in Boston, in arousing and directing public sentiment favorable to parks, resulted in the creation in 1892 of the Metropolitan Park Commission whose work is so well known. A little later the Appalachian Mountain Club had its charter powers extended to enable it to act as a trustee of lands for the use of the public.

New Hampshire conferred the power of trusteeship upon its Forestry Commission in 1893, and later the Society for the Protection of New Hampshire Forests was given similar powers. Maine, in 1903, chartered the Hancock County Trustees of Public Reservations for the purpose of acquiring lands on Mount Desert Island, and it was the lands thus acquired that formed the nucleus of the Acadia National Park. A public park association was incorporated in Rhode Island in 1905 for the same purpose and its work led to the establishment of the Metropolitan Park Commission in that state to acquire and develop parks in and about the city of Providence. Somewhat similar movements were started in Connecticut about the same time, and that state is the only one in New England today to have a park and forest commission to manage such properties throughout the state. In Massachusetts the general practice has been to place state reser-

[1] Presented at the Third New England Forestry Congress, Hartford, Conn., February 2, 1929.

vations under the management of various types of special commissions which usually are composed of local citizens appointed by the governor. The present trend in most of the New England States seems to be to put the management of all such areas under some state department. There is a steady increase in the acquisition of park and forest properties by the states and a growing sentiment in favor of making them more serviceable to the public.

The Connecticut State Park and Forest Commission has made splendid progress in the development of both the state parks and the state forests. Men technically trained in forest and park management are employed to direct the work of the commission, which explains in large measure why Connecticut in a few years has built one of the most serviceable park and forest systems in New England. The state does not lead in area of state parks (8513 acres) or state forests (43,919 acres) but the system of management now in force is certainly worthy of emulation.

In the State of Maine the management of public park and forest areas comes under various organizations. The Acadia National Park of 12,000 acres is the only National Park in New England and is controlled by the National Park Service. There are 33,130 acres of National Forest under the United States Forest Service. The state parks comprise 270 acres, the town forests 1300 acres, and forest lands owned by colleges and academies aggregate 12,000 acres. The school lands in Maine totalling 55,000 acres are under the protection of the Forest Commissioner. Three small reservations are held by the Appalachian Mountain Club as trustee for the public.

Massachusetts has 104,000 acres of state forests under the Commissioner of Conservation. Its state parks, beaches, and province lands aggregate over 27,000 acres and are managed by at least a dozen separate organizations consisting of county commissioners, special commissions, the Metropolitan Park Commission, and the Department of Public Works. Eighty towns have town forests with a total acreage of 10,500. There are approximately 50,000 acres, not in town forests, owned by municipalities for the protection of the water supply and these areas contain our oldest plantations. Eight reservations containing 505 acres are held by the Trustees of Public Reservations and 89 acres in four tracts are held by other organizations. If variety lent spice to park management, Massachusetts should have by all odds the most interesting state park system in the United States. The fact is that state park management in Massachusetts is conspicuous by its absence mainly because of lack of funds, and the latter condition is the chief virtue of the system. Nature has been free to take its course in most instances, and with the exception of the beaches the people know little about their reservations. The state park policy in Massachusetts presents a most difficult problem.

New Hampshire contains more publicly owned forest lands than all the other New England States together. It has 481,453 acres of National Forests, 29,163 acres of state forests, 14,376 acres of town forests including water protection areas, 28,133 acres owned by educational institutions, and 4621 acres held in trust by the Society for the Protection of New Hampshire Forests and by the Appalachian Mountain Club.

In Rhode Island there are 1742 acres in state parks, and over 11,000 acres are held for protection of water supplies.

Vermont has 34,000 acres of state forests. Educational institutions own 32,223 acres, and there are 8000 acres held by cities and towns as town forests and for watershed protection.

In addition to the areas mentioned in the respective states the county and municipal parks in New England aggregate 86,000 acres. No statistics are available to show the areas in other publicly owned lands such as town commons, school grounds, and cemeteries, but if we allow five acres per township for these uses we should add another 10,000 acres to the open spaces of Massachusetts. To get accurate statistics on all of the public lands of New England would require much time and money. With the exception of the last item, however, the figures given are believed to be reasonably accurate and the grand total shows that New England has 1,158,538 acres of publicly owned lands. Most of this land is open to the public for recreational use. Of the 66,424 square miles of area in New England, 6.7 per cent is water surface, which adds 2,800,000 acres more to the recreational area of the region, since most of the larger ponds are public property. It is conservative to say that approximately 4,000,000 acres in New England are available to the public for recreation.

A recent survey of the state parks and state forests in the United States made by the National Conference on state parks shows that there are 6,785,105 acres in these areas. This is 228 acres in state parks and forests per square mile, taking the country as a unit. In New England we have 4.04 acres in state parks and forests per square mile, or 1.8 times the average for the country on the area basis.

When we make the comparison from the standpoint of population the showing is not so good. Taking the country as a whole there is one acre of state park and state forest to 19 persons, while in New England the ratio is one acre to 30 persons. The density of population for the entire country is 39 persons per square mile while that of New England is 123. These figures show that we are behind the rest of the country so far as recreational area, compared with population to be served, is concerned. We have only eight acres of national forest land per square mile in New England while the national forest area for the whole country is about 50 acres per square mile. As a region we are far behind our neighboring states of New York and Pennsylvania. Pennsylvania has 1,200,000 acres in state forests alone and New York has nearly 2,000,000 acres in the Adirondack and Catskill Preserves.

In the matter of recreation so many factors enter into the equation that area alone may be of little importance in the attraction of the public. Climate, quality of scenery, good roads, hospitality, cleanliness, shade trees, absence of objectional forms of commercialism such as billboards and unsanitary hot-dog stands, and efficiency in management are only a few of these factors that will attract and hold public attention. That New England excels in the entertainment of tourists is shown by the hundreds of thousands of visitors that come to us each year.

We should not, however, close our eyes to our faults or fail to grasp the

opportunity to make of New England the greatest playground in this country. We should avoid the mistakes of our neighbors but on the other hand we should not be too stiff-necked or modest to copy a virtue. New England is a natural topographic and commercial unit and coöperation in the development of our forest and park resources will be of mutual benefit. We should adopt a plan of development for New England as if it were a single unit, and the individual states should vie with each other in the completion of their respective sections of that plan. Forest and park resources would be only one phase of such a plan, but their importance would be emphasized in a manner that would be reflected in increased public interest and likewise in public support.

A NEW ENGLAND RECREATION PLAN[1]

By BENTON MacKAYE

Vice-Chairman, Regional Planning Association of America

A PLAN is a picture—a visualization of some scheme. To be effective it must be nature's scheme—not man's. Planning is exploration. The civil engineer who plans an effective railway grade across a mountain range does not devise the grade, he finds it. He finds the line of least resistance in nature's topographic scheme. He reveals the setting for some activity. The railway grade is the setting for the activity of transportation. Transportation is a regional activity; so is agriculture; so is manufacturing. These form the industrial half of man's activity; recreation of some kind forms the other half. A plan for a region is the revelation of nature's setting for some activity.

Before exploring for the setting we first must know what activity is called for. Is it industry or recreation? Is it work or is it play? It must be one or the other, even though the two may be combined. We must know the objectives of each in order to provide that they will not conflict with one another. Also we must know the means for achieving the various objectives. These statements are platitudes, but engineering is based on platitudes—precise, however, not vague. Let us get our platitudes precise.

Industry is necessary for bodily existence. Its objectives are finite—food, clothing, houses, etc. And the ability to secure these objectives as efficiently as possible is itself an objective of industry. The less time spent in drudging to secure the means for mere existence the more time we have left to use these means for actual living. These objectives are finite and commonplace, but they are sublime. The means of industry consist of various forms and processes—thousands of them; we can dispose of them under the single word *mechanism*.

Recreation is not necessary for bodily existence (except a certain minimum), but it *is* necessary for real living. Recreation is not merely "non-industry," it is the reason for industry. Industry provides existence which is the base for living. Recreation is incipient culture—the final lap in the pursuit of happiness. Its objectives are not finite, they are infinite. They are the mysteries and the melodies of creation; they are pursued through science and art. The means of recreation and culture consist, as with industry, of various forms and processes; these we can dispose of under the single word *technique*.

Means and ends! To confuse these is the worst mistake that a planner can make—or the citizen either. Yet this is just what most citizens are usually doing. And this is why we must be precise about our platitudes. To worship any means for its own sake is fruitless, pointless, and too often disastrous. To worship technique for technique's sake—the forms and fashions of art—leads to nothing but

[1] Presented at the Third New England Forestry Congress, Hartford, Conn., Feb. 2, 1929.

a foppish cult barren of the basic vital interests of life. This is what the "transcendentalists" were supposed to be doing in England back in the mid-Victorian days when they were spanked warmly by the satire of Gilbert and Sullivan in that display of real art—the comic opera *Patience*. Equally barren is the mechanistic cult—born of the worship of the forms and fashions of industry. I refer to the present-day madness for instrumentalities—the radio, the moving picture, the high-powered motor car, and the other push-button fixtures of mechanistic civilization. In these cases there seems to be a tendency for mechanistic motion to be worshipped for its own sake.

There are two kinds of motions or movements in the world—the kind which counts and the kind which does not. The game of football illustrates both kinds. Forward movement down the field in the direction of the goal is the kind that counts. Lateral movement across the field between the yard lines does not count because the ball is no nearer the goal at the end of such movement than it was at the beginning. As with football so with life—our movement or activity is forward and fruitful or else it is lateral and fruitless. The difference may be further illustrated in two stories.

In *Alice Through the Looking Glass* one of the adventures takes place with a character known as the "Black Queen." This lady, seizing Alice by the hand, bids her to run with her as fast as she can. They start. "Faster, faster!" shouts the Black Queen. Alice goes into higher speed. "Faster, faster!" again shouts the Black Queen. Alice puts on full power. Suddenly both drop exhausted under a tree. "Where are we now?" gasps poor little Alice between her heart throbs. "Just where we were before," pants the Black Queen.

In a recent reminiscence of Henry David Thoreau a certain old farmer, after explaining that Thoreau's real name was "Da-a-vid Henry," gives the following description:

"One morning I went out in my field across there to the river, and there, beside that little old mud pond, was standin' Da-a-vid Henry, and he wan't doin' nothin' but just standin' there lookin' at the pond . . . . and when I come back agin if there wan't Da-a-vid Henry standin' there just as if he's been there all day, gazin' down into that pond, and I says, 'Da-a-vid Henry, what air you a-doin'?' And he didn't turn his head, but kept on lookin' down into that pond, and he said, as if he was thinkin' about the stars in the heavens, 'Mr. Murray, I'm a-studyin' the habits of the bullfrog!' And there that darned fool had been standin' the live-long day—a-studyin'—the habits—of the bullfrog!"

Thoreau stood still "the live-long day—a-studyin'." He was studying firsthand the habits of the bullfrog and the secrets of nature; and thousands of people today are happier for his activities in the field of "outdoor culture." His activity is recognized as being forward toward the goal of human enlightenment. The Black Queen ran herself into exhaustion and admitted she remained in the same place. Thoreau stood still and made progress.

The Black Queen represents the modern mechanistic cult—the worship of motion and transport for its own sake. Her activity is "lateral," not forward; she makes "transport" but not progress; we cannot call her a "transcendentalist,"

but we might with precise analogy call her a "transportationalist."

The activity of transportation and mechanization is a marvellous thing—but only when under control and kept in its proper place. This is in industry, not in culture or recreation. The objectives of industry are sublime—to provide the wherewithal for culture. We must develop the mechanistic phase of our civilization—but only as servant, never as master: we must never allow it to impair the primeval phase of our civilization—that environment of a full-bloomed, pristine nature which is the final source of all culture and enlightenment. A complete and balanced civilization requires both of these phases—the primeval and the mechanistic.

The city is the end product and cross-section of a *mechanical civilization*. It is more than this: it is the efflorescence of a total human civilization—both in industry and culture. It contains the waterfront and the railway terminal; and it contains the art gallery, the university, and the theatre. It is a focus of the high and low in human society—a measure of the tide "in the affairs of men." It is a marvellous product of the evolution of mankind. The forest on the other hand is the end product and efflorescence of a *primeval civilization* (for every forester knows that the primeval forest is an organized society). It is a product of the evolution of mankind's foundation. And so the forest is the root of man's society as the city is its head and flower. A civilization without its city would be a headless one; and a civilization without its forest is a rootless one. The forest alone without the city is the creator of the cave man; the city alone without the forest is the creator of the iron man.

Forest and city must grow side by side in any balanced civilization. When Sir James Bryce was ambassador to this country from England he made a speech in Washington in which he pointed out our capital city as one which appeared to be harbored in a forest. He referred, of course, to the shade trees which at that time so plentifully lined the city's streets. Because of these the view from the top of the Washington Monument presented a floral picture rather than a structural one. But shade trees are only the trimmings of the primeval environment. The forest as an entity must be woven within the matrix of our territorial development. Our early settlers first planted civilization by inroads of population through the forest; we today, in order to restore civilization, must develop forest inroads between our population centers. Only in this way can we effectively carry out the thought expressed by Mr. L. F. Kneipp of making "the forest a part of the life of the American people."

It is these "forest inroads" which, to my mind, should form the basis for any recreational plan for New England. They should form a series of embankments, or "levees," for controlling the flood of mechanistic civilization which is pouring forth, in the shape of temporal chaotic structures, along the motor ways outward from our metropolitan centers. This "flood" is getting out of hand. It is a notorious fact that the mechanistic phase of our society is, whether consciously or not, tending to run away with the whole of our society. It is stampeding society—just as the Black Queen stampeded little Alice. It is exhausting the energies of our society by moving our bodies and effects in a pointless, lateral movement over the face of the

earth while leaving us in soul "just where we were before."

Physically speaking the laying out of these forest embankments should form no very complex problem in regional planning. In general they should follow the main mountain ranges, the steep-sided river canyons, secluded river bottoms, and other belts and corners of land where soil and topography are better suited to the growth of forest than to agricultural crops. They should follow the line of the Berkshires, the Green Mountains, the White Mountains, and the backbone of New Hampshire, the north woods of Maine, the Deerfield, the Naugatuck, and the other canyons of the central peneplain, and such miniature glacial scenery as the Pine Barrens of Cape Cod. These belts may be called "wilderness ways" (linear extensions of the "wilderness areas" suggested by Mr. Aldo Leopold); they should form a framework of public parks and forests connected by a series of paths or primitive trails equipped with cabins and facilities for camping and general outdoor living. Such a system of wilderness ways, when developed, would form the setting for the primal phase of New England's civilization, interlocking with the mechanical phase exhibited in the metropolitan centers and highways. As shade trees are to the city, so these wilderness ways would be to mechanical civilization generally. Forest and city in New England would grow side by side.

But the real basis for developing, in New England or in any other region, the proper setting and environment for the activity of outdoor recreation and of the pursuit of culture at its sources, is more than physical—it is psychologic. It consists in the creation or development of a genuine human interest, within a critical group or margin of the people, in the movement forward toward the infinite goals of evolution in place of a temporal human infatuation with lateral motion and mechanical transport for its own sake. It is the development of evolutionists as against "transportationalists." And this development is under way. It is the American outdoor movement. Its equivelent in Europe is known as the Youth movement. It consists of the inevitable and irresistible impulse of humanity to right the balance of its civilization. It is a movement to uphold the primal phase of human life by a visioning of evolution on the out-of-doors horizon. It is the reposeful dynamics of "Da-a-vid Henry" versus the stampeding statics of the Black Queen.

Unprovided with this impulse, your public parks and forests and wilderness ways are a country without a prophet. And the impulse alone unprovided with its primal setting is a prophet without a country. It is the union of these two—of setting with activity—of the American forest with the American outdoor movement, which seems to be required in any real scheme for outdoor recreation. This is not my scheme, nor the scheme of any man, but it seems to be the scheme of nature. To develop this union in a definite series of wilderness ways, strategically located to control the streams of metropolitan flow—this to my mind is the fundamental policy behind any effective plan for recreation in New England. And only through this union, I believe, can we make of New England a land where we shall be content not merely to exist in fruitless motion but to *live* in the open field of evolution.

CAMP SITE PROGRAM ON STATE FORESTS OF PENNSYLVANIA[1]

By ALFRED E. RUPP

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Purpose of State Forests

THE WISE use and proper administration of forest land are probably the most important questions before the forestry profession today.

The constitution for forestry practice in the Keystone State was written by the "Father of Forestry" more than 34 years ago—three years before the first acre of state forest land was purchased, and six years before the Department was established. The important reasons advanced by Dr. Rothrock in recommending to the legislature that forest land be purchased for state forest purposes were:

1. "For the production of a timber supply to meet the needs of present and future citizens of the state.

2. "That watersheds might be acquired and maintained with forest cover so as to secure an even flow of water to foster the industries of the state, and feed her springs and streams.

3. "That the state forests should combine in themselves not only charm of scenery that would attract our population to them, but that they should also possess such altitude, purity of atmosphere and general health-giving conditions as would make them sanatoriums for those of our population who do not desire or could not go to more remote points for renewal of strength."

At that time the recreational use of land by the public was confined largely to the few park areas, publicly and privately provided. Accessibility was an important factor in their location, in order that they might be readily reached with the limited transportation facilities available.

Steam, electric, and water transportation companies were offering a wider field for outdoor recreation by establishing and maintaining pleasure parks. The delight of parents and children in the pre-automobile days was to go on excursions to picnic grounds on holiday occasions. Some of the state forest parks had their origin as parks created and supported by a railroad or trolley company.

As generously as historic, municipal, and transportation company parks were then patronized, it was apparent that they did not meet the normal needs of those seeking health by rest in an outdoor environment, or those who seek restful seclusion from business or family cares, or of those who have the urge for hunting, fishing, and tramping in the more distant stretches of the forests. This need was met in Pennsylvania by the purchase and administration of state forests.

[1] Presented at the meeting of the Allegheny Section, Society of American Foresters, Harrisburg, Pa., March 15, 1929.

Pennsylvania began to acquire forest land in 1898, and has purchased to the present time 1,290,000 acres. The state forest land purchase policy is founded upon her recognized responsibility for the welfare of her citizens. Forest destruction had proceeded to a point where Pennsylvania industries and homes were becoming more and more dependent upon outside sources for their wood needs. Millions of acres of land, good for no other purpose than to grow trees, were being left waste and overrun by fire. Forest communities, once prosperous, were left desolate, and the injurious effects of forest devastation on water supplies and local industrial activities were increasingly felt. A reforestation program was essential. Forest fires must be stopped; wanton waste of timber must be arrested; timber must be cut under sound forest practice; and tree planting must be undertaken where natural reproduction cannot be depended upon to restock the devastated areas. The state assumed leadership in forest restoration by becoming a landowner.

The state forests, as acquired, have been developed by the department under the policy of putting them to the highest use of which they are capable. They have thus become increasingly attractive and valuable. With fires kept out, and plantations established when necessary, promising young timber has replaced the unattractive and valueless land left by recurrent fires. Roads, trails, and other improvements have been developed to make the farthermost stretches of these lands accessible for protection, administration, and use.

Those in search of health and recreation in the outdoors have found in the state forests the opportunity to satisfy their desires at minimum expense. The use made of state forests by the public at first was largely transitory. Hunters, fishermen, and vacationists selected those spots which seemed to offer the best opportunity at the time for their enjoyment. It soon became apparent that means should be provided whereby the privilege of extended occupancy of areas for recreation should be granted to those desiring it.

Authorization of Camp Site Leases

To meet this need the Pennsylvania Assembly in 1913 authorized the department to lease suitable lands to citizens of the state for camping. The measure has provided the opportunity sought by the sportsmen, vacationists, and health seekers to become located comfortably on their choice spot in the forest. It has also afforded the protection needed to the investment made by campers desiring to construct a substantial building and make extensive improvements on the leased area.

Leases have been issued not only to individuals and clubs, but to large camp units, such as the Boy Scouts, the Girl Scouts, and the Y. M. C. A. The structures built by our 1945 permittees on permanent camp sites range from the inexpensive one-room shelter of the sportsmen to the fine modernly equipped summer home of the vacationist of means. Under its policy, buildings not needed for administrative purposes, and constituting a drain upon its appropriation to keep in reasonable repair, have been leased by the department to individuals and clubs upon the consideration of their improvement and maintenance in good condition throughout the term of lease.

The department is receptive to applications for legitimate recreational use from all citizens in the state, individually or in groups, to the extent to which suitable areas are available on state forests. It is but natural that the range of recreational facilities afforded on the state forests should attract citizens of every type. They have become the peoples' playground. This is indicated by the fact that on January 1, 1919, there were less than 400 permanent camp site leases in effect. On January 1, 1924, the number was approximately 1000. Four years later it had increased to 1840, while on January 1, 1929, there were 1945 leases in effect.

During 1928 the department received $17,717.72 in rentals, and up to the present time has received more than $100,000 in revenue from permanent camp sites, which have been paid into the State School Fund. The interest accruing from this fund is used by the State Council of Education in supporting poor school districts which are unable to collect from taxes sufficient funds to maintain adequate school facilities in their respective districts. Additional financial aid is given these poor school districts from the taxes received through the assessment of the buildings erected on permanent camp sites. The total value of the buildings is approximately $2,000,000. The average annual rental is approximately $9.

This revenue is now, and will continue to be, one of the major state forest incomes. In one forest the department is receiving an annual income of 5 per cent on the money expended in the purchase of the land.

In the erection of these buildings the department finds a ready market for its second grade lumber, and at the same time renders a distinct service to the permittee. It also makes possible the continuous employment of local labor, and the holding together of the small communities within the forested areas. The importance of this type of land use has been fully recognized by the department.

Committee Recommendations

In 1927 a committee of five foresters, of which I had the privilege of serving as chairman, was appointed by the state forester to study conditions and formulate a definite camp site program on the state forests of Pennsylvania. The main objects of this program, as outlined in the committee's report, are:

1. To correlate present procedures and consider their adaptability for future administration.

2. To assure a proper classification of land use in the state forests, in order to provide for public and private recreational needs.

3. To raise the standard of recreational use in the state forests.

4. To anticipate future recreational needs.

5. To eliminate unnecessary details of administration and effect the fullest coöperation between the department and its permittees.

It is the present aim of the department to anticipate the future recreational needs in the state forests and to satisfy these requirements in an orderly and efficient manner. This can be done by substituting a well-balanced and properly conceived program, some of the main features of which are given below, in place of the somewhat haphazard methods usually followed in the early stages of newly organized activities.

Forest Land Classification

Because of the increasing demand for camp sites, it is imperative that a survey be made of each state forest for the purpose of designating areas that are not available for permanent camp sites and indicating specifically the areas on which permanent sites will be granted. In designating the use of forest areas, preference should be given to the form of recreation that represents the highest use. Among the non-available areas are:

1. Areas desirable for general recreational use such as, state forest parks, state forest monuments, and scenic areas; also public camps, temporary camps, and other areas needed for administrative uses such as desirable locations for houses, cabins, and sawmill sites.

2. Areas needed for special purposes such as watersheds and impounding basins of dams.

Available Camp Sites

After all non-available areas have been determined, attention should be directed to those remaining areas, where semi-private use by individuals or groups will not conflict with administrative use by the department, or with public interests. Upon these areas, the local district forester should designate specific locations as available for permanent camp sites. A number of such sites, sufficient to meet the demands for at least one year, should then be surveyed and clearly marked.

Sites in remote or isolated sections should not be granted until after due consideration has been given to the manner of ingress and egress. The rights and desires of adjoining private landowners should be respected. A temporary number should be conspicuously placed on each available camp site. These numbers will be helpful to applicants in referring to the sites when they are being inspected and in making application for them. When a camp site has been leased, the temporary number will be discontinued and a permanent number given thereto. This procedure will eliminate the necessity of a special trip for the survey of each individual site.

Where camp sites are grouped, it is imperative that roads and driveways to and about the sites should be designated either before or at the time the sites are surveyed. In order to secure a coördinate system of roads, the lessee should be required to develop an approved driveway to his site over a designated route and should not be permitted to trespass upon adjoining sites. The department will not be responsible for any acts of trespass committed by its lessees.

Health Regulations

Nothing in connection with the camp site program is of greater importance than sanitation. Each district forester should see to it that the camp sites under his jurisdiction are models in this respect. Particular attention should be given to the location and maintenance of toilets and to the disposal of garbage. The camp site water supply is a serious question. Special precautions should be taken so that all springs and streams used by the public for drinking purposes are protected from pollution.

Building Requirements

Plans for all buildings, or additions thereto, must have the prior approval of the district forester both as to location

and the actual specifications of the proposed structure. The department does not require that buildings erected on the permanent camp sites must be distinctive or uniform in character, but it does require the lessee to comply with certain approved standards. These standards vary in different locations and conditions, but in general the buildings must be presentable in appearance.

Inspection of Sites

No activity is more vital to the success of the camp site program than proper supervision. This supervision should have for its purpose friendly coöperation between the department and the lessee to the end that necessary improvements will be made and acceptable standards maintained. Frequent visits to all camps should be made at a time when they are occupied. The personal contacts thus made will be helpful in securing a better understanding between the lessees and the department personnel. Inspections at intervals not exceeding one year should be made of all camp sites in each forest district.

Permanent Camp Sites Rules and Procedure

In addition to the general policy outlined above, the following rules of procedure for the guidance of the personnel of the department in their work in connection with the leasing of permanent camp sites and the subsequent supervision thereof have been approved:

HOW TO MAKE APPLICATION

1. Application for a permanent camp site lease shall be made in duplicate to the Harrisburg office, or to the local district forester. If the application is made to the district forester, the original application shall be forwarded immediately to the Harrisburg office; if made to the department, a copy of the application will be promptly sent to the district forester.

2. All questions on the application blank must be answered by the applicant.

3. All persons having a financial interest in the camp must be citizens of Pennsylvania.

4. No person is allowed to hold a financial interest in more than one camp used for the same purpose. For example, a member of a hunting club holding a permanent camp site lease, may not lease or become a member of another similar camp, unless he first withdraws from the original camp. However, a member of a hunting camp may lease another site for family purposes.

5. All persons having a financial interest in the camp must sign the application. As new members are added, their names must be submitted by the lessee, in order that they may be added to the original application.

6. All applications for camp sites must be accompanied by a sketch showing the general building plan and the material to be used in its construction.

7. When two or more applications are received for the same site, the first application filed shall be given prior consideration, provided the applicants are equally desirable.

8. Applicants shall be informed before the survey is made that the department cannot guarantee to make any road improvements to the site, and cannot assure the applicant of any exclusive rights, other than those pertaining to

the leased premises. In some localities it may be desirable to keep considerable unoccupied space between camp sites. Rentals on such sites will be higher than on similar sites in more congested areas.

LOCATING AND MARKING CAMP SITES

1. All surveys must be made by compass using magnetic bearings. The camp site boundary lines must be accurately measured. Each survey must be tied to some permanent object, such as a spring, stream, bridge, state boundary corner, or road intersection, giving the bearing and distance.

2. Notes must be recorded in permanent form in a surveyor's note book, giving the bearings, distances, and the type of corner established, together with a sketch showing all major details on the ground. Where trees are used as corners, the species and diameter breast high should be given.

3. Permanent corners must be established. Where trees are used, they are to be blazed on two sides, one blaze facing each line. Where stakes are used, they should be surrounded by stones, if possible. Other near-by trees can be marked with one blaze on the side facing the corner. Where camp sites are close together, it is advisable to paint a red band around all corners, or to use iron pipe corners. (This may be done by the lessee.)

4. The area included in a permanent camp site lease shall not exceed one-half acre. The maximum area should be granted only in exceptional cases, and ordinarily 100 feet by 100 feet, or one-fourth of an acre, is sufficient. Whenever possible, surveys should be made square or rectangular.

5. Camp site boundaries shall be not less than 50 feet from lakes, dams, and road intersections, and not less than 20 feet from roads or streams. The nearest boundary line shall be not less than 50 feet from any spring or stream used for drinking purposes, when the site is below the spring or stream. When the site is so located that the drainage is toward the spring or stream, the distance shall be not less than 300 feet.

The program also provides for the approval of the material to be used in the building, and its location on the site. It further provides for the reports and recommendations of the district foresters as to the advisability of granting the lease and the considerations under which the lease shall be transferred or renewed, as well as the field and office procedure.

PLACE OF RECREATION

The experience of the department during the last 16 years has been most helpful in preparing this program. The successful accomplishments under it are dependant upon the wisdom, tact, and ability of the administrator. It must be administered in the spirit of fairness and helpful coöperation with the full realization that the state forests are the people's property for the people's use. They must be made to serve continuously the citizens of the state. Their resources must be developed and used to yield the greatest good to the greatest number. Recreation in them will play an increasingly important part, not by usurping areas susceptible of higher use nor by curtailing the utilization of needed resources, but by the use of areas best suited for that purpose, and by the recreational appeal of all properly protected and managed forest land.

"BETTER WOODLANDS FOR BERKS"

By C. R. ANDERSON

Extension Forester, The Pennsylvania State College

MAKING his aim "Better Woodlands for Berks," County Agent Chas. S. Adams of Berks County, Pennsylvania, has carried on a piece of forestry extension work during the last three years which is, to say the least, interesting to foresters from the standpoint of the methods used in attacking the problem. The purpose was to secure an acceptance by a greater number of the farm-woodlot owners of the county of the idea that stands of young to middle-aged timber might be improved greatly by thinning, to the end that they would try the work on a part of their lands.

The situation within the county when the work was begun was described by the extension forester as follows:

"The present timbered area on the farms of the county is approximately 48,000 acres. Outside of the farms there is calculated to be 67,000 acres of woodland. These two combined total 115,000 acres, which gives an area of 19 acres for every farm in the county. No figures are available to show what per cent of this land is covered with trees under 20 years of age and therefore not ready for any thinning work. The amount of timber beyond improvement-cutting age is small. Assuming that 50 per cent will cover the two—a fair assumption, we believe—we still have nearly 60,000 acres with which to work. Too often the practice in the past has been to cut the piece of land clean when cutting. In fact, it has been almost the only way the Berks County farmer has proceeded with the job of getting his year's wood. Only here and there has a farmer been located who has been pursuing any other course. A very large percentage of the farmers of the county burn wood during a part of the year. Many use no other fuel except during the coldest weather. In many of the villages of the county there is a steady demand for any excess wood which the farmer may have."

The timber is very largely mixed hardwoods, of the several mixtures common in southeastern Pennsylvania, with a touch of the northern hardwoods here and there in the higher parts of the county along the mountains to the north and west. Some of the lots contain as many as twenty different tree species, good, poor, or medium so far as saw timber production goes.

Thinning demonstrations had been held within the county from time to time for three years. There was a man here and there convinced of the value of the project. The time seemed ripe to try for "spread of influence."

The Plan for the Work

A tentative plan was drawn up in chart form showing what was to be done and when, for the guidance of both county agent and extension forester. It assembled necessary points in orderly fashion. It covered the work of one year, to be superseded at the beginning of the next year of activity by a new chart. The one displayed herewith pertains to the third year of work.

Work Chart, Berks County

Better Woodlands Project, 1928-29

	Prior to October	October	November	December	January-February	March-April
Organization ...	Call launching meeting Saturday, August 11, with Executive Committee and leaders. Revise prospect list with leaders.	Have leaders help with "Reasons" contest. Add to prospect list.	Have leaders arrange for coöperators for demonstrations and for illustrated meetings. Add to prospect list.	Secure enrollments ...	Secure enrollments ...	Leaders report on progress of thinning. Leaders assist in securing reports from those who have thinned.
Meetings, Demonstration, Tours	Make stop on regular farm tour at one or more thinning demonstration areas.		Arrange for demonstrations. Arrange for illustrated meetings. Five minute talks at all other farm meetings.	Hold 4 or 5 demonstrations—community. About one week later hold large central demonstration—county-wide. Five minute talks at all other farm meetings.	Series of indoor meetings, illustrated. Five minute talks at all other farm meetings.	Five minute talks at all other farm meetings—March.
Publicity, Circular Letters, News Notes, Advertising.	Wide distribution of poster "Signs of the Times." Prepare new letterheads after launching meeting. News notes following launching. News notes—last year's results. News notes—"Reasons" contests. News notes on other important parts of program. News notes on poster distribution. News notes—selected coöperators of last year.	One circular letter shortly after middle of month, WSAS subject matter. One circular letter on "Reasons" contest. News notes on circular letter. News notes—"Reasons" contest. News notes—Selected coöperators.	Two circular letters, one early one late in month. WSAS subject matter. One circular letter announcing demonstrations and contests. Arrange for small space paid advertising. News notes on circular letters. News notes on progress of "Reasons" contest. News notes on demonstration and contest.	One circular letter giving results of demonstrations and contests and soliciting enrollment for thinning. Arrange for small space paid advertising. News notes following demonstrations. News notes on coming county-wide demonstration. News notes following county-wide demonstration. News notes on prizes—timber sticks. News notes on enrollment.	One circular letter to those not responding already—WSAS subject matter. Arrange for paid advertising. News notes on coming indoor meetings. News notes following indoor meetings. News notes on subject-matter. News notes on progress of thinning project.	News notes on subject matter. News notes, selected coöperators. News notes on enrollment.
Contests	Plan "Reasons" contest.	"Reasons" contest about middle of month.	"Reasons" contest continues.	Tree-marking contests at demonstrations—sets timber sticks as prizes. Contest ditto at county-wide meeting—contestants all former winners; saw as prize.		

When the "launching" meeting occurs, the directors of the Agricultural Extension Association receive and discuss the proposed plan. Just as it stands, or modified as the result of the discussion, it becomes the approved program for the carrying forward of the work.

The advantages of the work chart, or calendar, are apparent. It enables the county agent to know at all times just what he has to do in connection with the project at any period. The work is all on the chart, or is supposed to be. And as fast as any particular piece of work is taken care of, it can be crossed off, or checked, so that it constitutes a record of the progress of the project. Without some such arrangement, it is altogether likely that certain items would be neglected or at least deferred too long.

In deciding what to put on the chart we were fortunate in having the very competent advice of H. W. Hochbaum of the Agricultural Extension Service, Washington, D. C. It was he who pointed out to us various ways, means, and agencies, from which definite points could be selected for use. Please note the plurals just used; it appears wise to provide more than one "medium." On this project as planned and executed occur:

1. A series of four circular letters to a selected prospect list.

2. A stop or a farm tour.

3. A wide distribution of a prize poster made the preceding year.

4. A "Reasons-for-thinning" contest.

5. Field thinning demonstrations.

6. Indoor meetings on thinning, illustrated.

7. Short talks at other farm meetings.

8. Tree-marking contests at field demonstrations.

9. News notes on everything, before and after.

Circular Letters and Other Helps

The circular letters used are of a type which Hochbaum has taught us to call W-S-A-S letters. The mystic letters stand for "want," "solution," "action," and "satisfaction." Letter No. 3 of the Berks County series follows as an example:

"S-A-V-E! You are advised frequently by the bank, the insurance company, the bond house, to save for a rainy day, for old age, for next Christmas or next summer's holiday. The saving in every case calls for an investment of pennies, dimes or dollars, each repeated, perhaps, many times in the year. But here's a saving that is different—it asks for no money. Wouldn't you like to have a savings account into which you put only labor, winter labor, and that perhaps only once every ten years? A savings account which pays big interest?

"Save the good trees! Cut the poor trees! Save the straight, tall, well-crowned, sound, fast-growing trees of kinds of timber which are worth money. Cut the crooked, short, bushy-crowned, diseased, slow-growing trees, and those of kinds which sell for very little money. Winter labor will do it, those odds and ends of days which come between pressing farm jobs.

"Watch your good woodlot grow into a better lot, after thinning. Enjoy, with hundreds of other Pennsylvania farmers, the pleasure which a well-thinned woodlot gives. And remember, they have made dollars doing the thinning. Possess, as they do, a woodlot which is a real savings account.

"Please return the enrollment card to us."

You will note that there is an appeal to a "want" in the first paragraph

of the letter. Many other wants which may be used will occur to the reader who revolves the problem in his mind. Those used in the two preceding letters were an outright appeal from the money side of the question, and an appeal with reference to the permanence of income; the fourth letter referred to the desire to cut expenses.

The "solution" to the "want" follows directly upon the expression of the latter. Then appear "action" and "satisfaction," but not necessarily always in this order. The two are transposed in the letter given above.

The circular letter-heads used to date in the several counties have featured stands of young timber, or of some product of the forest, to catch the eye. The one used this year in Berks County is a representation of the county itself. In addition the following suggestions as to trees to "Cut" and "Save" have been used without change on all letter-heads during the past three years:

CUT

1. Crooked trees.
2. Short, bushy-crowned trees.
3. Diseased trees.
4. Slow-growing trees.
5. Poor timber trees.
6. Some trees where too thick.

SAVE

1. Straight trees.
2. Tall, well-crowned trees.
3. Sound trees.
4. Fast-growing trees.
5. Good timber trees.
6. Enough trees to the acre.

The poster which was widely distributed over the county was made from the prize poster of the preceding year.[1] In that year's work the schools were reached through this medium. Two classes were established, one for all high schools within the county outside the city of Reading, and one for all upper grades within the county but outside the city. There were three prizes in each class.

Envelope stuffers were used in the county for two years; they were omitted this year. Every first-class letter from the county agent's office, regardless of the subject with which it deals, whether hogs, hens, or hay, during the months of November to March inclusive, carries one of these stuffers.

Other Ways and Means

It is evident that there are a variety of things which we may select to assist us in putting our program over, even some which are neither found on the work chart shown nor mentioned already. The first year of the project in Berks County an essay contest was used in connection with the rural schools. A window display was also used the same season, and proved of interest. As commonly arranged, blocks of several species of wood were beveled off slightly at one end so that a number could be painted on the specimen. The blocks were then set on end in a window. The windows chosen were those of rural stores whose owners were willing to loan the use of the space for a few days. It is surprising what can be done with from 12 to 20 blocks, each representing a good or a poor tree for

[1] Copies of this poster and of other illustrative material referred to in the article will be furnished to any one interested on request to the author at State College, Penn.

the woodlot owner, especially if the window is backed with brown paper and the floor space surrounding the blocks covered with fallen leaves. The brown paper backing may be used to tell the public what it's all about. Cards with numbers corresponding to the numbers on the blocks may be provided. Those identifying the specimens correctly may have their names placed upon an honor roll which is later featured in the county newspapers; or they may be made the recipients of a small prize for their knowledge and display of industry.

The following year, the blocks may again be used for a counter display. The blocks may now be picked up and handled by the persons looking at the display. The setting of leaves is left out, the blocks being laid upon the counter. A piece of cardboard about 15 by 24 inches with two winged extensions 12 by 15 inches makes an excellent background for the counter exhibit, serving to carry the message, to shut off the exhibit from nearby distractions, and to make it easy to set up and to take down.

Small prizes may or may not be offered in the window or counter display contests. The blocks are usually plainly divided into two groups, one comprising trees which are good from the woodlot owner's standpoint, and a group which is the very opposite. The counter displays in Berks County were set up in the lobbies of banks. Three separate sets were made and circulated, each set being on exhibit for a week at four or five points.

The store keepers of the crossroads villages report various interesting data with respect to the interest in these exhibits. In one county, sparsely settled, approximately 600 persons examined the exhibits critically at the 10 or 12 points where they were set up. Of these, one in twenty filled out a card identifying the wood specimens.

The Climax of Effort

We usually consider the field demonstrations as marking the climax of the project. Ordinarily if a man can be induced to come to a field meeting, he will agree to try out the work. Consequently circular letters, essay contests, poster contests, window displays, farmers' tours, "Reasons-for-thinning" contests—everything—should build up interest steadily to the point when the field meetings occur. Please note these are held in December in the case of the work chart shown, although the project was initiated in August. In all the counties in which the project has been put on to date the field meetings are put in November or December. They cannot come very well before the regular farm work incident to crop harvest falls off; and they should come early enough to get hold of the farmer before he cuts his usual wood supply.

At the thinning meeting it is exceedingly desirable to get just as high a participation in the job of marking trees as is possible. Participation fixes the principles of selection in thinning in the minds of the farmer, and gives him a greater measure of confidence when he undertakes the work on the home woodlot. In the fall of 1926, we first adopted the idea of using numbered labels and numbered cards to correspond. The labels may be shipping tags or even pieces of tough paper. More recently we have been following the lead of Extension Forester Cope in using the round white, two and a half inch, metal-bound Den-

nison tag. These are more permanent. The cards may be varied, of course. Fifty trees are provided for; but some other number may be used. "Reasons" may or may not be filled in on the cards.

Each farmer attending the meeting is handed what we call an "Intention-to-thin" card. This usually sets forth the fact that the person signing is interested in the thinning work, that he owns a stated number of acres, and last but not least, that he "proposes" or "plans" to thin a stated number of acres during the fall and winter.

Goals

The goal set for Berks County during the third year was two hundred farmers who would apply the work. At present writing it is somewhat doubtful whether the goal has been reached. There are unquestionably some men thinning of whom the county agent does not yet have record; there are also some of those who have signed the cards who have not been able to reach their expectation. But for every one who has signed, and thinned, there are, we believe, two who have expressed the wish that they had timber to which the work would apply. We know that the influence is widespread in Berks County.

In one other county of the state, during the first year, one farmer in every ten—the county is very sparsely settled—signed up. The goal was 50; the signers number 51. The second year this county is expected to increase the number to 100, although full reports are not yet available.

All of our county agents in Pennsylvania who have tried the general plan of securing "spread of influence" are satisfied that the method is worth while.

FOREST TREE SEEDLINGS

FOR REFORESTATION OR FOR DISTRIBUTION?[1]

By CHAS. R. MEEK

Chief, Bureau of Extension, Pennsylvania Department of Forests and Waters

Why the State Grows Trees

IN CONSIDERING why a state distributes small forest trees, let us first review the reasons for beginning this practice. In the early days of forestry in this country many people, seeing abandoned fields and cut-over and waste land and having come in contact with the forest tree plantings in Europe, concluded that extensive tree planting would be necessary in order to reforest quickly and profitably with the best species. The next problem was the source of supply of suitable planting stock.

At that time few nurseries in the United States could furnish forest trees at a low enough price to reforest cheaply, or in large enough quantities to meet the demand. Accordingly, the state felt obligated to arrange for the raising and distributing of the necessary stock. Nurseries were started and trees were sold to the public at low cost in order to encourage reforestation as a means of providing a future timber supply.

The educational feature of forest tree seedling distribution by the state is also of inestimable value. That the public learn to appreciate the forests as of intrinsic value both to their owner and to the public is a necessary step in the development of a general "forest consciousness."

I believe that we can rightly conclude that the state is in the business of furnishing forest tree seedlings because it is necessary under present economic conditions; that it is a valuable agent in furthering the individual appreciation of the economic value of forests to the Commonwealth; and that the fundamental idea of insuring a future timber supply is sound.

The State's Responsibility

The question arises as to whether the state's work is finished when the trees are shipped. Some foresters believe that our work should stop there; many others feel that because the state is making a substantial investment in the general future timber supply by furnishing free advice and planting stock at low cost it is obligated to see that effective reforestation results. This view I believe, is sound.

Where the attitude of the state is that of concern for effective use of the trees in reforestation, it is necessary to provide for ample field supervision. Usually most of the requests for assistance in planting problems came within a very short period in the spring. It is then almost a physical impossibility for the regular force to examine individually all

[1] Presented at the meeting of the Allegheny Section, Society of American Foresters, Harrisburg, Pa., March 16, 1929.

the proposed planting sites and to supervise the actual planting operations. To get results, however, this difficulty must be overcome.

The state itself owns approximately 1,290,000 acres of land, of which 30,000 acres are now in need of reforestation. Most of this, however, is in cut-over and badly burned woodland which at the present time is difficult of access and consequently exposed to fire danger. Nearly all of the bare accessible areas have been reforested.

On the other hand, there is a large area of idle fields, abandoned farms, and land with little valuable tree growth in private ownership in Pennsylvania that must be reforested by artificial means if it is to produce a valuable tree crop within a reasonable time. Taking these facts into consideration, it seems to me clear that the privately owned land offers the greatest reforestation opportunities. With land at $5, trees at $3, and planting at $10 per acre, the total initial investment for each acre of land reforested is at least $18, to be carried until the crop is harvested, with resulting benefits to the public in general as well as the landowner. It seems that if the private tree planter is willing to make this investment in the hope of profitable financial returns, or present personal satisfaction, the state is justified in encouraging him.

Reforestation Progress

To date over 37,000,000 forest tree seedlings have been planted on the state forests, reforesting approximately 25,000 acres. If the reforesting is continued at the same rate as during the last 12 years, the balance of the state forests needing planting will be covered in less than 40 years.

Through the Department of Forests and Waters over 75,000,000 seedlings have been distributed to private forest tree planters, and at the rate of 1,500 to the acre approximately 50,000 acres should have been reforested. In the light of some information I shall give later it will be seen that this figure can safely be cut in half. If the privately owned forest land is reforested at the rate of 11,000,000 seedlings per year, which was the rate last year, and if 1,500 trees are planted to the acre, we can reforest 7,300 acres per year. At $18 per acre this area represents an annual investment on the part of the public in reforestation of at least $131,400.

Are the tree-planting efforts of private individuals meeting with success commensurate with the investment? If present results are satisfactory, then we may well continue the distribution of forest tree seedlings and leave the " reforestation " to look out largely for itself as it has had to do in most cases in the past. If results are not satisfactory, then what must we do in order to accomplish the reforestation for which we are striving?

With the answering of these questions in mind and with the state's 19 years' experience in distributing forest tree seedlings to the public, it was felt that the time had come to discover the facts.

Plantation Survey

During 1928 a check up was made of the private forest tree plantation situation in 20 counties, so picked that the survey would be representative of the entire state. One was in the neighbor-

TABLE 1

NUMBER OF TREES PLANTED AND SURVIVAL BY SPECIES

Species	No. of trees planted	No. of trees now growing	Survival per cent
White pine	1,746,310	693,250	40
Scotch pine	1,171,780	519,115	44
Jack pine	114,770	56,423	49
Norway pine	344,326	144,407	42
Japanese black pine	25,387	9,931	39
Japanese red pine	160,462	74,588	46
Shortleaf pine	124,850	49,239	39
Pitch pine	595,996	245,406	41
Lodgepole pine	50	0	0
Table Mountain pine	13,500	1,941	14
Virginia pine	11,200	302	3
Austrian pine	17,700	8,900	50
Bull pine	2,000	0	0
Western yellow pine	2,600	1,360	52
Norway spruce	1,139,434	501,659	45
White spruce	89,850	43,751	53
Colorado blue spruce	1,202	117	9
Englemann spruce	100	5	5
Red spruce	1,000	0	0
Japanese larch	177,888	75,760	42
European larch	233,180	59,562	25
White ash	225,115	77,723	34
Green ash	17,650	2,863	16
Sugar maple	38,409	10,187	26
Boxelder	2,472	893	36
Hard maple	40	15	37
White oak	22,600	8,256	37
Red oak	152,070	17,829	11
Chestnut (rock) oak	58,300	891	2
Arborvitae	18,378	846	4
Black locust	82,800	20,936	25
Honey locust	15,375	658	4
Black walnut	27,377	8,942	32
White mulberry	88	12	14
Red mulberry	100	0	0
Catalpa	13,470	3,125	23
Shellbark hickory	700	145	26
Pecan hickory	10	0	0
Black cherry	10,000	5,180	51
Serviceberry (juneberry)	400	0	0
American elm	83,897	405	0
Tulip poplar	14,860	5,061	34
Willow cuttings	9,800	280	3
Cottonwood cuttings	100	0	0
Yellow poplar	500	0	0
Persimmon	3	0	0
Sycamore	1,000	0	0
Miscellaneous	23,325	1,181	5

hood of a large city, one in the hard coal region, one in the soft coal region, one in the grazing belt, one in a farming community, one in an industrial center, one in the smoke and gas affected hills, and so on. The plantations themselves were taken at random. In all 961 plantations of more than 47 species of forest trees in seven state forest districts were examined. These plantations were originally stocked with 6,792,000 seedlings or transplants.

Table 1 shows the percentage of survival by species in the plantations. All species are included, although in at least 25 the number of trees planted was too small to give a basis from which worthwhile conclusions could be drawn.

The examinations showed that 281 plantations had an establishment of 75 per cent or better and can be called successful. Twenty-one plantations had an establishment of from 50 to 75 per cent and can be classed as partially successful; while 659 plantations had an establishment of less than 50 per cent. It must be remembered that a number of different men examined these plantations, and while all used the same method, yet in the difficult problem of determining the cause of failure in an older plantation, the personality of the examiner affects the conclusion drawn. Also, where several causes of failure were given, one of these was taken as predominant and the result so classified. Plantations made for ornamental purposes were classed as failures because they will not result in reforestation for timber production.

Table 2 shows the cause of failure in the 680 plantations with a survival of less than 75 per cent.

TABLE 2

CAUSE OF FAILURE IN PLANTATIONS WITH SURVIVAL OF LESS THAN 75 PER CENT

Cause	No. of plantations
Ornamental	108
Dense shade	118
Poor planting	107
Grazing	81
Weeds and grass	67
Miscellaneous	46
Fire	44
Trees discarded	30
Poor planting stock	28
Heaving	22
Theft	12
Smoke and gas	7
Rodents	5
White pine weevil	5

The successful plantations were sometimes affected by adverse factors, which are shown in Table 3. It is obvious, however, that if over 75 per cent of the trees were growing and healthy and the plantation classed as successful, no evidence of serious damage was present.

TABLE 3

ADVERSE FACTORS AFFECTING SUCCESSFUL PLANTATIONS

Factor	No. of plantations
Weevil	37
Dense shade	22
Weeds and grass	17
Insects	9
Miscellaneous	7
Grazing	6
Deer	6
Heaving	6
Sawfly	4
Fire	4

Here and there the examiners discovered successful plantations of various species that were outstanding in one way or another; these were mentioned specifically and described in the reports. Of the plantations with over 75 per cent

success, it is interesting to know that 163 out of the total of 281 were not appreciably affected by any adverse factors.

Table 1 can be studied to advantage, especially when making planting recommendations and planning a nursery program. The evergreens on the whole made a better showing than the hardwoods. Results, however, as indicated by the percentage of survival by species, cannot always be accepted at their face value. This is because other factors later in life may make the plantation a failure even though in youth the percentage of survival is high. For instance, in black locust the percentage of survival may be high but borer attacks may later make the plantation a failure. Also black walnut may be an apparent success in youth and unsatisfactory as to growth later, even though there be a high percentage of survival.

Reforestation Committee

Early in 1928 a Reforestation Committee was appointed by the state forester to study the results shown by the plantation survey, including the kind and size of tree planting stock distributed from the nurseries, the methods of shipment, the species chosen, etc. This committee, after considerable study and nursery inspection, made the following recommendations. It is interesting to note that these in general agree with the recommendations made by the district foresters who were actually engaged in the field inspection.

1. That planting operations on the state forests should receive the personal attention of the district forester or his assistant, in order to insure the most careful planting practices.

2. The inspection of all private forest tree planting sites and planting operations by representatives of the department.

3. The modification of the present plan for nursery production as follows:

Species	Percentage in present plan	Percentage recommended
White pine	27.5	22
Norway (red) pine.	27.5	30
Scotch pine	10	7
Pitch pine	8	10
Norway spruce	11.33	15
Japanese larch	7	7
Other conifers	2	2
Red oak	1.33	2
White ash	2	1
Black locust	2	2
Black walnut	0.67	0.67
Yellow poplar	0.33	1
Other hardwoods ..	0.33	0.33
	100.00	100.00

4. The production of standard seedlings of a specified minimum size and stockiness.

5. Spring planting and wise mixture by species.

6. Careful planting with spacing 5 x 5 feet or closer.

7. Wise selection of the best species adapted to the soil.

8. Reinforcement of the plantation when percentage of establishment falls below 75 per cent and before the original plantation exceeds 2 feet in height.

9. Adequate protection against fire, grazing, trespass, insects, fungi, and other destructive agents.

10. Avoidance of planting on newly cut-over land, brush land, and in shade except under very favorable conditions.

11. Careful counting and grading of nursery stock.

12. Raising of sufficient transplants to meet the demand.

13. Liberation cuttings to be avoided where the species liberated is worth less than the overstory.

14. Tree planting to be done in the most careful manner with quality stock, and in such a way that weeds and sod are cleared away from about the trees.

Some of the committee thought that as there is so much hardwood growth in Pennsylvania and so little evergreen reproduction, that the state could easily afford to stress the planting of evergreens and raise comparatively few hardwoods; especially in view of the fact that the money spent in planting hardwoods could often be used to better advantage in improving woodlots of hardwoods already established. Another factor mentioned was that there are now so many accessible fields in abandoned farms which can be planted cheaply with high percentage of survival that underplanting should not be encouraged.

Summary

Taking the reforestation problem as a whole, from our experiences I have come to the following conclusions:

1. The state distributes forest trees for reforestation purposes and incidentally this results in many instances in educational advantages.

2. The state's work is not finished with the production and shipment of seedlings. Successful reforestation can be accomplished only by having field men inspect sites, supervise plantations, and follow up the work to see that the plantations are properly reinforced and protected.

3. There are cases where the planting agreement with the state is violated, but these are in the minority and can probably be lessened by education.

4. It is necessary to adopt such practices as will insure thorough inspection, good nursery practice, proper planting methods, and helpful supervision to ensure a very high percentage of plantations successful for timber production.

5. A greater amount of research work in tree raising and planting is needed to help solve many planting problems.

Knowing the problem that we have to face and also having some measure of the results accomplished in the past 19 years, we can now put our fingers on the weak spots and concentrate in our efforts to strengthen them. I believe that the survey of the 961 plantations of all ages has been of great value in opening our eyes as to what is and what is not being done; and it has been amazing to discover what is not being accomplished and why.

EFFECT OF EXCESSIVELY HIGH TEMPERATURES ON CONIFEROUS REPRODUCTION

By FREDERICK S. BAKER

Associate Professor of Forestry, University of California

IN observing the distribution of seedlings in the forest, the relative scantiness of reproduction on southern as compared with northern exposures leads inevitably to the conclusion that open, sun-beaten southern exposures are too hot and dry for the best survival of the seedlings. Obviously, "hot and dry" covers a multitude of factors, and, if real understanding of the situation is to be obtained, an analysis is necessary to determine whether it is the heat or the dryness that kills. The study reported here covers an investigation into the problem of heat relations of seedlings to determine the importance of this factor, especially in the coniferous stands of the Pacific Coast.

The subject falls naturally under six rather distinct heads, each of which will be discussed separately after the general plan of the experiments has been described:

1. The nature of direct heat injury in the open.

2. Reaction of protoplasm of different species to high temperatures.

3. Reaction of protoplasm of seedlings of different ages.

4. Relation of internal temperatures to external air and soil temperatures.

5. Protective devices in conifers.

6. Effect of morphology and age on extent of injury.

Methods of Investigation

SEEDLINGS

Seedlings of the following conifers were grown in the greenhouse in shallow containers, galvanized iron pans 1 foot square being used in 1927, and half-pint oyster pails in 1928:

Pinus coulteri (Coulter pine)

Pinus ponderosa (Western yellow pine)

Pseudotsuga macrocarpa (Bigcone spruce)

Pinus pinaster (Maritime pine)

Abies grandis (Grand fir)

Pseudotsuga taxifolia (Douglas fir)

Sequoria sempervirens (Redwood)

Sequoia gigantea (Bigtree)

Cupressus macrocarpa (Monterey cypress)

Cupressus goveniana (Gowen cypress)

Chamaecyparis lawsoniana (Port Orford Cedar)

Thuja plicata (Western red cedar)

Picea sitchensis (Sitka spruce)

These seedlings were grown in the local, dark adobe soil, but this was covered with a layer of about one-fourth inch of coarse sand to make a more uniform top layer and one that would heat up readily and also dry out rather quickly after watering. In order to prevent mutual shading the seedlings were thinned out as much as necessary. Originally an attempt was made to keep track

of the age of all seedlings, but this proved impossible, so that only in the first experiments is the age of the seedlings known very accurately. Later on, their development was described in terms of size rather than age, which appears more satisfactory since growth is more rapid in some individuals than in others. Tests were made on these seedlings at all ages, from the time the first loop of the stem appeared above the soil until they were fairly well hardened—at an age of approximately three months. Most of them were tested at about the time the first leaves were beginning to develop above the cotyledons and the stem was still decidedly succulent.

METHOD OF EXPOSURE

To test the effect of intense insolation upon the seedlings, a pan or paper pail of seedlings was arranged on a bank of sand before a radiant electric heater, being tilted so that the rays struck the surface at an angle of 65°. Figure 1 shows a typical exposure of a shallow pan of seedlings, the unused seedlings at the back being shielded by a paper. The method is essentially that of Bates (3) except that the surface sand layer was always dry while the deeper soil layers were adequately moist.

RECORDING TEMPERATURES

Owing to the nature of the study mercury thermometers could not be used, because internal tissue temperatures and surface sand temperatures were to be measured, both demanding placement of the recording unit within half a millimeter of space. Neither could air temperatures be readily measured by this means, owing to the absorption of radiant heat by the mercury bulb. Accordingly thermocouples were resorted to because of

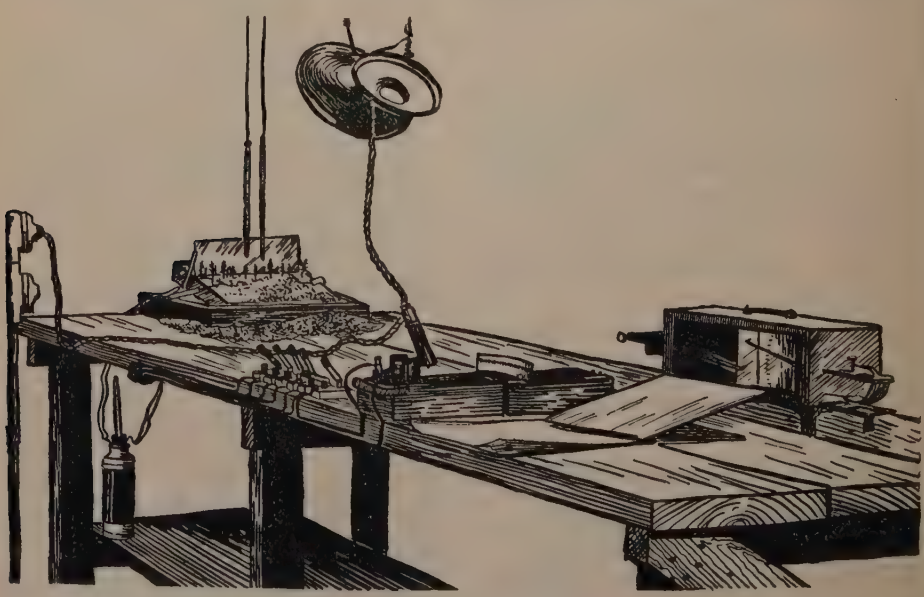

FIG. 1.—Typical exposure and set-up of instrumental equipment

their small size and low heat capacity. Accuracy was a secondary consideration.

These thermocouples consisted of constantan-copper junctions welded after the method of Clum (5). Two sizes were used. The first year the thermocouples were made of wire .125 mm. in diameter, the welded junctions being about .3 mm. in diameter. The second year smaller wire .075 mm. in diameter was used with the resulting junctions only about .18 mm. in diameter. These were inserted into seedlings with much less injury than the larger ones and proved more satisfactory generally. A series of couples was made and so arranged that each one could be thrown into circuit with the galvanometer (Leeds and Northrup Type No. 2400-B), and the so-called " cold " couple, which was fastened to the bulb of a mercury thermometer and thrust into a thermos bottle of water at about 50° C. (123° F.). All couples were calibrated by running them in water at different known temperatures.

In every test thermocouples were thrust into the base of the stem of at least two seedlings, invariably through needle holes in the north side, and two other couples were also buried under one layer of sand grains close at hand. The rest were disposed with less uniformity. Unshielded mercury themometer readings were also taken for comparison in the air at the level of the tops of the seedlings.

It can not be claimed that the readings represent the temperature at the point of injury by heat with extreme accuracy, because, in the first place, there is great difficulty in placing the thermocouple accurately at the desired point, and, secondly, there is always some conduction of heat through the wires leading to the thermocouple. Furthermore, there was also a constant and rapid fluctuation in temperature—slight in the upper soil layer (a few tenths of a degree), moderate in the bases of the young seedlings (1 to 2 degrees), and very violent in the case of thermocouples exposed in the air. In order to get fair averages, the mean of five galvanometer readings made as rapidly as possible was used.

METHOD OF TEST

The thermocouples being arranged in the base of the tree, the sand, or the air, as the case might be, the heater was turned on, usually about 3 to 4 feet distant, and temperature readings of all thermocouples and supplementary mercury readings in the air were taken at 5 to 20 minute intervals, usually 10 minutes, and were immediately followed by an examination of the seedlings for injury. As a rule the temperatures were gradually raised and the test was discontinued as soon as obvious injury appeared in the seedlings. This injury was first indicated by tiny white dots appearing on the south side of the base of the stem. This was followed by discoloration, shrinkage, and withering. As noted by Sachs in the earliest experiments of this kind that were carried out, the injury is not invariably immediate and may not appear for several days, and in practically every case the injury becomes much more severe after standing a few hours, even after watering. This is apparently due to the fact that while the cells are killed their water is not withdrawn for some little time.

Nature of Direct Heat Injury

The fact that plants can be injured by direct heat of the sun was unrecognized for a long time.

In 1883 Hartig (10) noted "stem girdle" in coniferous stock and referred it to freezing of shallow pools of water about the trees. Later the same sort of injury came to the attention of foresters in Germany, not only in seed beds but where natural reproduction was taking place. The freezing theory was disproved and instead the injury was laid to *Pestalozzia* for some time, but as repeated inoculation experiments with this and other fungi were fruitless (33, 22), this theory too had to be abandoned. The occurrence of this injury in the hottest places at last led to the discovery that it was a direct heat injury, as apparently first suggested by Mayr (20). A similar history is found in America, with Hartley (11) the discoverer of the true nature of what he had called the "whitespot" injury, which he had supposed at first to be a "damping off" disease.

Thus, while it is true that air temperatures are never high enough to involve the whole seedling in direct heat injury, the surface of the soil does become heated enough to cause injury to the stem at the ground level. In the case of small seedlings during the first few weeks of life it takes the form of the "whitespot" described by Hartley (11). He says:

"The whitespot lesion is very light in color and the characteristic color extends to the very edge, making a sharp line of demarcation from healthy tissue. The lesions were at first a dark greyish green, changing in 24 hours to the light color and shriveled appearance of whitespot lesions on seedlings in the nurseries."

This whitespot is found only on the south and southwest sides of plants with large stems or when only moderate injury has been done. Where the stems are small or the injury severe, it may girdle the whole stem, and the plant may lop over, an appearance much like "damping off."

The present writer in watching the progress of injury under strong radiant heat has noted the first indication of injury to be the loss of glaucous bloom (as in some pines, notably *Pinus pinaster*). Other conifers with reddish stems, especially Douglas fir, show a destruction of red color at the point of heating, making a little green spot. At other times, with nearly all species of conifers, tiny white dots have indicated the onset of injury. What these may be has not been determined; possibly some of the epidermal cells have burst. Next there is usually a general darkening if the tissue is at all succulent, giving the stem a bruised appearance, followed by longitudinal wrinkling. The well-developed constriction comes only some hours after the heating, due to loss of water from the dead cells. Death may not occur even though the plant is girdled, providing the plant is strong and does not lop over. Hartley (11) shows that death in injured plants is often due to secondary attacks by fungi. Mortality is high as a general rule, however.

In the cases where serious injury is noted, death often occurs rather promptly, in a few hours, without any obvious change in the area of the lesion as noted when fungi attack the seedling. Cross sections of such injured stems show the endodermis and xylem distinctly brownish or olive green, the balance of the tissues (except the epidermis) being practically colorless. This appearance

certainly suggests that death may take place through the development of toxins as shown by Dixon (8) in the case of steam-killed twigs.

The damage is not limited to young and tender seedlings but has been noted in Europe by Tubeuf (33) and Münch (22) in 2-year-old spruce. The same is true in America where it caused heavy damage at a nursery in the Wasatch Mountains of Utah (11, 16). In these older trees, however, a lesion is caused only on the south side—not a complete girdling—and a swelling is produced above the point of injury. Such injury is directly related to the familiar "sun-scald" of fruit and ornamental trees.

Reaction of Protoplasm of Different Species to High Temperatures

The determination of the highest temperature that flowering plants can tolerate for short periods without showing injury or death was first suggested to Sachs (27) in 1864, on account of the wide discrepancies between the accounts of travellers and naturalists who had from time to time noted plants growing in very hot soil about hot springs and fumaroles. He used small potted plants of *Nicotiana rustica* (tobacco), *Cucurbita pepo* (pumpkin), *Zea mais* (corn), *Mimosa pudica* (mimosa), *Topaeolum majus* (nasturtium), and *Brassica nupus* (rape), placing them in a hand-regulated incubator with glass doors and holding them at predetermined temperatures for various periods of time. All species stood temperatures of 49°-51° C. (120°-124° F.) without harm but none stood a temperature above 51° C. (124° F.) over 10 minutes without severe injury or death.

Immersion in water at 49°-51° C. (120°-124° F.) killed the plants however. Sachs made no attempt to explain this. An obvious explanation might be that the poor conductivity of air allowed the stems and leaves in the incubator to remain a little cooler than the indicated air temperature, whereas they would quickly come up to the water temperature. Tubeuf (34) in 1914, however, presented data that indicate lack of oxygen may be the most important factor in this case.

Since the time of Sachs many other similar experiments have been carried on, either holding the plants at determined air temperatures in incubators as did Sachs, or measuring the tissue temperatures by means of delicate thermocouples. The chief results are given in Table 1.

Disregarding MacDougal's figures for cactus, Bates' results (for reasons presented later), and Leitch's results with pea roots, it is apparent that in spite of a wide variety of methods and plants, the thermal death point for average mesophytic plants lies between 122° and 131° F., an exceedingly narrow range.

One of the most striking points in all these studies has been the suddeness with which the death point has been reached. Below the critical temperature the plant continues to exist without the faintest suggestion of injury. Raise the temperature a few degrees and almost immediately injury becomes clearly apparent. Illert (13), Collander (6), and especially Lepeschken (18), working with more refined methods, dealing in some cases with single cells and particularly choosing species in which death is marked by a definite color change, have thrown much light on the reasons for this sud-

den thermal death point and the nature of the change that takes place.

Primarily it is due to the coagulation of the albuminous substances within the cell, a process that in its chemical aspects is not unlike an explosion, in that it is exothermic—heat is given off—and in that its rate does not conform to the van't Hoff-Arrhenius law that the speed of chemical reaction is doubled for each 10° C. rise in temperature, for the temperature effect instead of doubling becomes 25 to 80 times more rapid, as in the case of three flowering plant tissues—*Tradescantia,* cabbage, and beet, used by Collander (6). For these three species the time required to kill the cells was as follows:

TABLE 1

INFLUENCE OF HIGH TEMPERATURES ON DIFFERENT PLANTS

Species of plant	Maximum temperatures		Injury	Observer	Notes
	° C.	° F			
Pea (roots)	45	113	Death	Leitch (17)	
Lilac	50	122	Death	Clum (5)	Thermocouples.
Privet	50	122	No injury	Clum (5)	Thermocouples.
Fuchsia	48–50	118–122	Death	Clum (5)	Thermocouples.
Iris	50	123	Heat canker	Harvey (12)	Thermocouple.
Prunus cerasus	51	124	Burning	Blackman and Matthaei (4)	Int. thermo-couple.
Tobacco, pumpkin, corn, mimosa, nasturtium, rape.	49–51	120–124	No injury	Sachs (27)	Incubator.
Tobacco, pumpkin, corn, mimosa, nasturtium, rape.	over 51	over 124	Injury or death.	Sachs (27)	Incubator.
Carpinus (leaf)	51.5	125	Death	Molisch (21)	
Conifer seedlings	52	126	No injury	Münch (22)	Incubator.
Sempervivum montanum.	52	126	No mention	Askenasy (2)	
Conifer seedlings	54	129	Death	Mayr (20)	
Conifer seedlings	54–55	129–131	Death	Münch (22)	Incubator.
Iris, vinca corn, beans	47–55	117–131	Death	DeVries (7)	Incubator.
Conifer seedlings	51–55	124–131	Death	Baker	Thermocouples.
Galtonia	59	138	Killed all but guard cells.	Leitgeb cited by Jost (14).	
Conifer seedlings	40–60	111–139	Injury or death.	Bates (3)	Incubator.
Cactus	62	144	None	MacDougal (19).	Int. temp. mercury ther.
Conifer seedlings	60–66	139–150	Death	Bates (3)	Open air.

Temperature	Tradescantia	Cabbage and beet
50° C. (122° F.)	46-252 minutes	
55° C. (131° F.)	44 minutes	3-5 minutes
60° C. (139° F.)	4 minutes	Few seconds

From these indications it appears that as much damage may be done in a few minutes at 131° F. as will appear after an hour or more at 122° F.

To determine the temperature coefficient of the reaction on coniferous seedlings, or indeed upon any plants having tissues of any thickness, is a very difficult matter as Collander found in the case of pea roots, where at border-line exposures some cells were killed and others lived.

Without going into this and other difficulties, the following results are presented from an experiment in which Monterey pine seedlings a few weeks old, and just developing their first primary leaves, were sealed with their roots in shell vials of water at room temperature and were then suspended with their tops dipping into hot water.

An exposure of 2 minutes in water at 54.5° C. proved about as damaging as 5 minutes at 51.6° C. The chemical reaction increased 2.5 times with a rise of 2.9° C., which is equivalent to an increase of 28 times for a rise of 10° C. An exposure of 1 minute in water at 54.5° C. caused an injury very similar to an exposure of 15 minutes at 48.9° C. In this case injury proceeded 15 times as fast with an increase in temperature of 5.6°, which is equivalent to an increase of about 100 times for 10°. These results are upon too poor a basis to be depended upon alone, but as they check very well with those of Collander cited above, it is probable that they are substantially correct.

TABLE 2

INJURY FOLLOWING IMMERSION OF TOPS OF MONTEREY PINE IN HOT WATER

Water temperature		Time of immersion	Results
° C.	° F.		
54.5	130	1 minute	Slight injury visible after 10 days; recovery certain after 20 days.
		2 minutes	Dead in 10 days.
51.6	125	1 minute	No injury.
		2 minutes	No injury.
		5 minutes	Slight injury visible in 8 days, dead in 11 days.
		15 minutes	Dead in 5 days.
48.9	120	1 minute	No injury.
		2 minutes	No injury.
		5 minutes	No injury.
		15 minutes	Slight injury in 15 days, recovery certain after 20 days.

It must not be assumed from these results that because plants are killed only at temperatures of roughly 120°-130° F. they can live and complete normal life cycles at temperatures immediately below this; for between 120° F. and about 95°-100° F. lies a zone in which very few mesophytic plants are able to grow. In this temperature range

it appears that photosynthesis is unable to keep up with the catabolic changes taking place within the plant and so growth ceases, chlorophyll tends to decompose faster than it can be made, leaves turn yellow and fall or wither, and the plant sooner or later dies. This is fundamentally different from the direct coagulation effect that is the basic cause of the type of injury noted in this study.

While such studies as have already been cited indicate that a large number of common mesophytes are directly injured by temperatures running roughly from 120° F.-130° F., no investigators have attempted to show the difference in resistance within a single group, as the conifers, except Bates and Roeser (3), whose extensive work demands a rather critical review since it will be repeatedly referred to.

In brief, Bates ran three series of experiments:

1. Exposure of seedlings to full sun heat in greenhouse, also artificially heated, with different degrees of soil moisture.

2. Exposure of seedlings to high temperatures in incubator.

3. Exposure of seedlings to intense radiant heat in pots, soil well watered.

Series 1 is dismissed rather summarily by Bates on the ground that the plants suffered from lack of water as well as the high temperatures. As long as the wilting coefficient was not reached by the soil containing functional roots, it is hard to see what direct effect low moisture content could have had. The injury was typical basal injury, and it is not surprising that it should show a certain correlation with soil moisture, for as Münch (22) shows, soil moisture is the chief factor in keeping soils cool. Bates found that injury occurred most seriously in lodgepole pine with Engelmann spruce, white pine, western yellow pine, and Douglas fir following, about the order that might be expected from the present writer's results. In spite of Bates' doubts, the writer feels that these were essentially dependable results.

It must be pointed out that there is nothing to indicate that these four species actually have different thermal death points *within their cells,* for there is nothing to indicate what internal temperatures were reached. As will be shown later, all seedlings do not assume the same internal tissue temperature at ground line for the same external temperatures. While, therefore, this test indicates behavior in general it does not throw light upon the coagulation temperatures of the cell albumins.

From Series 2 Bates concluded that seedlings of all species show about the same thermal death point when exposed in an incubator. Injury appeared with temperatures as low as 111° F. and some individuals survived exposures at 139° F. This wide variation seems characteristic of experiments with incubators and is perhaps due to uneven heating. The conclusions reached by Bates agree with those of the present writer, but Bates distrusted them on the ground that differences in transpiration—and hence cooling effect of evaporation—were prevented by the saturated still air of the incubator, and that true differences in the behavior of different species could only be discovered by exposing them in the open air.

Bates' third series was therefore arranged much like Series 1 but sunlight was reinforced by an electric radiant

heater and the soil was kept moist. This latter feature spoiled all the naturalness of the experiment that had been sought, for instead of lesions at the ground line, the normal injury in nature, Bates shriveled and cooked the cotyledons and upper stems by intense direct heat. As will be shown later, the two forms of injury are by no means equivalent for certain protective devices which are very important in preventing basal injury are prevented from coming into play and the two "microclimates" about the tree, with wet soil and dry soil, are quite different. It is quite impossible to transform the air temperatures (unshielded bright bulb thermometers) secured by Bates into true air temperatures or plant tissue temperatures for comparing his results with others.

In view of the unnatural kind of injury brought about by the use of wet soil and the uncertainty as to what his recorded temperatures mean in terms of plant tissue temperatures, his series—lodgepole pine, most resistant, followed by western yellow pine, Engelmann spruce, and Douglas fir—cannot be accepted as truly representing the relative heat resistance of the four species under natural conditions, while still less can his mercury thermometer readings be accepted as indicating that seedlings can become as hot as 150° F. and still live, or even that they can live in air at that temperature. Indeed nothing can be deduced as to tissue temperatures.

In Series 2, the incubator experiments, there is much more probability that internal temperatures actually closely approached those indicated by the mercury thermometer, and in spite of the truly enormous range of temperatures within which both injury and survival is noted, the results warrant somewhat close scrutiny. The tabular results given by Bates (3) for western yellow pine, lodgepole pine, Douglas fir, and Engelmann spruce may be summarized by saying that with exposures of 1-10 minutes partial survival (usually failure of about 40 per cent to show injury by wilting) occurs at all temperatures up to and including 134.5° F. with all species except lodgepole pine (132.5° F.). Beginning with 135° F. (or 134.5° F. with lodgepole pine) wilting of all specimens of all species is noted except for a single series (1 minute at 139.0° F.) where only 40-60 per cent of the specimens of all species show injury. Clearly little or no difference in the behavior of these four species is shown, and apparently a rather positive dead line lies about 134-135° F. (air temperature).

The experiments of the writer already described allowed the determination of internal temperatures of stem bases which were injured or uninjured. Table 3 presents the data secured.

An inspection of Table 3 shows clearly that there is little or no difference between the various species. When the internal temperature rises to the critical point, basal injury is noted in all of them. The figures in the column headed "No Injury" are rather more significant than those in the column headed "Injury," because it is possible for injury to be noted although the recorded internal temperature may not be very high owing to the displacement of the thermocouple in the stem, for as has already been noted, the area where injury takes place is very small and the stem rapidly becomes cooler both downward into the soil and upward into the air so that it is entirely possible for the thermocouple to be

TABLE 3

RELATION BETWEEN BASAL INJURY AND INTERNAL TEMPERATURES AS MEASURED BY THERMOCOUPLES

Species	Maximum temp. in °F.		Character of basal injury
	No injury	Injury	
Pinus coulteri	117	...	None.
	121	...	None.
	...	121	Possible discoloration.
	125	...	None.
	126	...	None.
	128	...	None.
	131	...	None.
	...	131	Constriction.
	...	132	Constriction.
	...	132	Constriction—killed.
	...	136	Constriction—killed.
	...	136	Constriction—killed.
	...	136	Constriction—not killed.
	...	137	Constriction—killed.
	...	140	Constriction—killed.
	...	140	Constriction—killed.
Pinus ponderosa	121	...	None.
	...	123	Spot on south.
	125	...	None.
	125	...	None.
	...	133	Constriction—killed.
	...	134	Slight injury.
	...	137	Slight injury.
	...	139	Constriction—not killed.
	...	143	Constriction—not killed.
	...	143	Constriction—not killed.
Pseudotsuga macrocarpa	125	...	None.
	129	...	None.
	130	...	None.
	...	134	Constriction.
Pinus flexilis	...	152[a]	Constriction—killed.
	...	158[a]	Constriction—killed.
	...	132	Constriction—killed.
Pinus pinaster	...	128	Glaucous bloom gone on south side.
	...	129	Small area killed on south side.
	...	131	Constriction—finally killed.
	...	133	Constriction—finally killed.
	...	135	Constriction—finally killed.
	...	135	Constriction.
	...	136	Constriction.
	...	136	Constriction—dug for examination.

TABLE 3—*Continued*

Species	Maximum temp. in °F.		Character of basal injury
	No injury	Injury	
Pinus pinaster	...	136	Constriction—dug for examination.
	...	140	Constriction—dug for examination.
Pinus attenuata	122	...	None.
	125	...	None.
	126	...	None.
	126	...	None.
	127	...	None.
	127	...	None.
	127	...	None.
	...	128	Discoloration.
	128	...	None.
	...	129	Typical constriction.
	130	...	None.
	131	...	None.
	131	...	None.
	...	131	Constriction.
	...	131	Discoloration.
	...	132	Constriction.
	...	140	Killed bodily.
	...	145	Constriction.
Pseudotsuga taxifolia	...	130	Constriction.
	131	...	None.
	...	133	Spot on south side.
	133	...	None.
	...	137	Constriction—lopped.
	...	138	Constriction—lopped.
	...	139	Constriction—lopped.
	...	142	Constriction—lopped.
Abies grandis	...	121	Constriction—killed.
	123	...	None.
	128	...	None.
	...	130	Basal discoloration.
	...	148	Killed bodily.
	...	154	Killed bodily.
Sequoia sempervirens	116	...	None.
	120	...	None.
	...	125	Constriction.
	...	127	Slight discoloration.
	...	128	Killed by thermocouple insertion.
	...	131	Constriction—killed.
Sequoia gigantea	115	...	None.
	...	122	Killed by thermocouple insertion.

TABLE 3—*Continued*

Species	Maximum temp. in °F.		Character of basal injury
	No injury	Injury	
Cupressus macrocarpa	116	...	None.
	120	...	None.
	120	...	None.
	...	123	Slight injury.
	124	...	None.
	124	...	None.
	...	125	Probably injured by thermocouple only.
	...	125	Possible slight injury.
	126	...	None.
Cupressus goveniana	...	119	Slight injury.
Thuja plicata	96	...	None.
	...	138	Killed bodily.
	...	140	Killed bodily.
Chamaecyparis lawsoniana	...	124	Injury by thermocouple only.
	...	132	Basal constriction

[a] First sign of injury at 134° F.

placed at a point cooler than where the injury takes place. On the other hand, if no injury takes place, it is obvious that the danger point has not been exceeded anywhere in the stem. An inspection of the column headed " No Injury " shows that all the maximum temperatures noted lie at 131° F. or lower, with the exception of a single case where 133° was noted. A less sharp line appears in the second column headed " Injury," but even here it is clear that above 131° F. injury is almost invariably noticed, while from this temperature down to 121° F. injured seedlings are occasionally found.

Of course, this injury which has been noted is not dependent entirely upon temperature. The length of exposure also comes into play, and it must not be concluded from the evidence which shows 131° F. as the critical point that temperatures of say, 128° F., are harmless regardless of length of exposure. At the same time study of the original figures does not indicate that the injuries noted at temperatures of 130° and lower are due to extremely long exposures. They seem much more likely to be due to accidents such as displacement of thermocouple and actual injury from wounding, a matter that will be discussed somewhat more at length. The real cause of the suddenness with which injury is noted when a temperature somewhat above 130° is reached is the high temperature coefficient of the reaction. If we assume a coefficient of 50, which seems reasonable and conservative in view of the results of Collander (6) as well as the rough indications of the writer's experiments, and an exposure of one minute at 131° F. as fatal, the fol-

lowing exposures at other temperatures would give the same result:

°F.	Time Minutes
131	1
130	1.2
129	1.5
128	1.9
127	2.5
126	3.3
125	4.1
124	5.0
123	6.0
122	7.2
121	9.2
120	11.5
119	15.0
118	18.0
117	22.5
116	27.2
115	33.0

The reason that the present series of experiments fails to show a time-temperature relationship, in which injury at low temperature would be correlated with long exposures, is due to the fact that the temperatures were continually fluctuating so that an integration of the time-temperature effect was out of the question.

It is the opinion of the writer that the temperature coefficient is probably considerably above 50, in which case the apparent suddenness of injury at the critical point would be still more emphasized.

Reaction of Protoplasm of Seedlings of Different Ages

If a study is made of the cases in which injury appeared at temperatures much below 131° F., it will be found that in the majority of cases it occurred in very young seedlings with the cotyledons hardly pulled free of the seed coat, indicating that age may be a factor in determining resistance to high temperatures.

Korstian (15) working with oak seedlings noted an increase of resistance with age correlated with lignification of the stem, which may have served as a protection to the living cambial cells. Bates (3) comes to the conclusion that resistance increases with age. In view of these indications, the possibility of there being a specific difference in resistance with age was carefully investigated with the three species *Pinus pinaster, P. coulteri,* and *P. attenuata,* the results being incorporated in Table 3, some seedlings so young that only the "loop" appeared above the ground being used. Very few "out of line" values are to be noted. A further investigation made by wounding untreated seedlings with thermocouples led to the belief that the injury noted at relatively low temperatures, as in the case of *Abies grandis, Sequoia sempervirens, S. gigantea, Cupressus macrocarpa, C. goveniana,* and *Chamaecyparis lawsoniana,* was due to thrusting too large thermocouples into small, tender tissues. The negative results with the three pines cited above, were with the use of small couples in fairly large stems. Although the proof is not rigid, the indications are quite positive that there is no increased *protoplasmic* resistance with age, although as will be shown later the resistance of the *seedling as a whole* does increase owing to the development of protective devices.

Relation of Internal Temperatures to External Air and Soil Temperatures

If 131° F. marks the line at which injury to protoplasm is certain and quick

in all species, it is of great importance to know the external conditions which are capable of developing such internal conditions.

It is obvious on general grounds that varying factors of radiation, conduction, evaporation, and nature of the soil must all affect the relation between the tissue temperature and the temperature of the surroundings, so that no single soil temperature can be pointed to as the critical one. Then, too, field observations under sunlight are difficult and time-consuming. The following observations have been made, however, showing roughly the soil temperatures correlated with heat injury in the field.

Mayr (20) found temperatures ranging as high as 58° C. (136° F.) in seedbeds where damage was presumably being suffered, although he is not entirely clear on this point.

Observations by Münch (24) are much more definite. The first observed damage in 1914 came April 29 with a surface soil temperature of 48.5° C. (119° F.). More general damage was observed June 4 when surface soil reached a temperature of 54½° C. (130° F.), followed by more on July 1 and 2 when the seasonal maximum of 64° C. (147° F.) was reached.

Toumey and Neethling (32) present similar data showing that a sustained soil temperature of 121°-123° F. may cause heat lesions on white and red pine. When the temperature reaches 135°-142° F. for 30 minutes all the red pines and 80 per cent of the white pines in the beds were affected. When the sand temperatures stood at 144°-150° F. for an hour, injury to the youngest trees appeared in 15-30 minutes, medium-aged trees in 30-45 minutes, and the oldest trees in 45-60 minutes. The limit of safety seems to be at about 122° F. for two-hour exposures.

Ramann (26) noted injury to oak seedlings in south Russia where surface soil temperatures went as high as 54°-60° C. (129°-140° F.).

Korstian (15) found that young oak seedlings were uninjured until soil temperatures exceeded 131° F. Injury to unlignified tissues was noted at soil temperatures of 138°-145° F., while over 149° F. the stems were completely killed.

Korstian and Fetherolf (16) observed temperatures as high as 130° F. at the Cottonwood Nursery in Utah where spruce transplants were injured, but observations were made on only two hot days and injury to older stock with a well developed bark is not immediately apparent.

Bates (3) using moist soil found injury correlated with air temperatures as low as 111.4° F. (Douglas fir) and 135.0° F. (western yellow pine, lodgepole pine, and Engelmann spruce). At the same time no injury was noted on certain trees at temperatures as high as 152.2° F. (Douglas fir), 161.1° F. (Engelmann spruce), and 181.8° F. (western yellow pine and lodgepole pine). These anomalous results due to the form of his experiments should be accepted only in a most general way.

These results indicate that damage may first appear when the surrounding soil is as cool as 117° F. (Toumey and Neethling). It becomes general when 130° F. is much exceeded, and above 150° F. it is so severe that few seedlings survive.

In this connection it is of interest to note some of the maximum surface soil temperatures that have been noted from time to time.

From this table it may be seen that dangerously high temperatures may be met with on bright, summer days throughout the temperate zone at altitudes as high as those occupied by the spruce type.

where overhead heating was used in the laboratory the damage appeared below the ground line and seemed due to conduction from the hot soil.

Bates (3) on the other hand held that the plant was cooler than its environment, the degree of undercooling depending upon the rate of transpiration.

Table 4

MAXIMUM SURFACE SOIL TEMPERATURE RECORDS

Temperature ° C.	Temperature ° F.	Soil character	Locality	Observer
54–60	129–140	Black	S. Russia	Ramann (26)
68	154	Dark-moor	Germany	Mayr (20)
58	136	Seedbed	Germany	Mayr (20)
65	149	Needle strewn sand	Germany	Ebermayer, cited by Mayr (20)
62	144	Sand	Germany	Münch (24)
50–55	122–131	General	Germany	Münch (24)
64	147	Needle strewn	Germany	Münch (24)
84	183	Sand (not growing season)	Tropics	Schimper (28)
69	156	Sand (growing season)	Tropics	Schimper (28)
	130	Sandy loam	Utah Mts.	Korstian and Fetherolf (16)
	160		British Columbia (spruce)	Alexander (1)
	136	Sandy loam	New Hampshire.	Toumey and Li (31)
55	131	Sand dune	Lake Michigan.	Tubeuf (33)
50	122	Gravel slide	Pikes Peak	Tubeuf (33)
60	140	Gravel slide	Yosemite	Tubeuf (33)
	143		Appalachians (oak type)	Korstian (15)
	154		Colorado	Bates (3)
	145	Sand	Nebraska	Pool (25)
	152	Sandy loam	Connecticut	Toumey and Neethling (32)
	152	Sandy	Nebraska	Hartley (11)

Hartley (11) held that the temperature of the stem was usually higher than that of the surrounding soil because the injury occurs just above ground level in the majority of cases, and attributed it to the combined effect of direct radiation coupled with reflected heat. In cases

The relation of leaf temperatures to the temperature of the surrounding air has been investigated by a good many workers who in general have shown that under laboratory conditions the temper-

ature of the leaf is higher than the air, the most striking case being that reported by Smith (30) who found the internal temperatures of leaves rising as much as 16° C. (28° F.) above the air under the tropical sun of Ceylon. Workers in temperature climates have shown less striking differences (see discussion of literature (5) by Clum), and those working with leaves most nearly under natural conditions, for example, Clum (5), Mrs. Shreve (29), Ehlers (9), have found no significant differences between leaf and air temperatures except on very still days. Sometimes the leaves are cooler than the air but never many degrees, and Clum (5) who carefully studied this point was unable to attribute any appreciable cooling effect to transpiration. No studies bearing on the relationship of surface soil temperatures to plant temperature at the same level have been made. Münch (23) discusses the theory of the matter at some length pointing out the immense differences in the heat properties of different types of soil due to different colors, specific heats, radiation, and conductivity. These factors interact to make dark soils heat up more than light, loose soils more than compact, dry soils more than wet or damp, some of the differences being remarkable. As a result dark loose moor soil is very dangerous to seedlings; loose dry sand is about equally bad, sandy loams follow, and light-colored, compact clay soils are very cool.

The seedling receives heat by radiation (direct or reflected) and by conduction from the surface soil; it radiates heat and conducts it into the ground on the one hand and into the air on the other. Obviously its temperature relationship to the surface soil layer cannot be very constant. In all cases where extensive damage has been noted the soil has been dry and loose—the type that heats up on the surface to a point far above air temperatures and temperatures at deeper soil layers. In such soils of poor conductivity and high absorption, it appears most likely that the plant stem will tend to be cooler than the soil due to its higher specific heat (water content), and its better conductivity, especially into the cool soil below but also into the air above. Conceivably the upward-moving transpiration stream may also play a part in bringing cool water up from below, although Mayr (20) has shown that even in such massive organs as tree trunks this effect dies out rapidly above ground level.

The figures in Table 5 show the differences between surface soil (sand) temperatures and internal temperatures noted in the present series of experiments. The surface soil temperatures were taken by thermocouples laid down and sprinkled with dry sand until they just disappeared from view. Internal stem temperatures were taken by thermocouples as previously described. The figures in this table include all observations in which internal temperatures ranged between 120° F. and 140° F.

In Table 5 the species have been arraged in order of stem size, starting with the largest. It will be noted that there is a certain tendency for the difference between the external sand temperature and the internal tissue temperature to decrease with the smaller-stemmed trees, indicating that the coarser species have somewhat better chances of survival in severe sites, although the variation is irregular and none too clear. But virtually all seedlings are able to maintain a stem temperature 15°-20° F. cooler

than the surrounding sand under the particular conditions of this experiment. If the same relation holds in nature a superficial soil temperature of 145°-150° F. is the critical point in loose, dry sandy soils.

severe, seedlings may remain at temperatures considerably below (15°-20° F.) the superficial soil temperature even at the critical ground line, large coarse seedlings tending to remain cooler than the smaller, more fragile plants.

TABLE 5

EXCESS OF SAND TEMPERATURES OVER STEM TEMPERATURES FOR VARIOUS SPECIES

(Within the Range of 120°-140° F. Internal Stem Temperature)

Species	Temperature difference in ° F.		
	Mean	Maximum	Minimum
Pinus coulteri	19.0 ± .7	32	7
Pinus ponderosa	21.3 ± 1.0	35	11
Pseudotsuga macrocarpa	30.0 ± 1.3	42	24
Pinus flexilis	12.5 ± 1.0	29	5
Pinus pinaster	19.5 ± .6	28	11
Pinus attenuata	Not determined	..	..
Pseudotsuga taxifolia	17.5 ± .7	21	8
Abies grandis	13.6 ± .9	23	7
Sequoia sempervirens	17.2 ± 1.3	24	3
Sequoia gigantea	Insufficient data	..	..
Cupressus macrocarpa	16.5 ± 1.2	30	8
Cupressus goveniana	Insufficient data	..	..
Thuja plicata	Insufficient data	..	..
Chamaecyparis lawsoniana	2.2 ± .7	6	0

How "natural" these laboratory experiments were and whether they favored or discriminated against the seedling are debatable points. Certainly the soil was abnormally moist just below the surface, for the plants were frequently watered. Also the air currents from the sides were probably cooler than the hot breezes close to the soil surface on quiet summer days—both factors favoring the loss of heat by the seedling in the laboratory.

To summarize, then, it can be said that these tests indicate that in soils of the type where heat damage is most

PROTECTIVE DEVICES IN CONIFERS

The data presented above indicate that fatal internal temperatures are reached by different species under different external (surface sand) heat conditions, the injury varying with age and with species. This variable amount of injury has been noted by other investigators.

Münch (22), for example, noted the heaviest losses in spruce and fir, then maple, white pine, Douglas fir, other pines, and last of all beech. In the last case he pointed out that the early leaves made almost perfect shade at the foot

of the seedling. In other cases he came to no conclusions regarding the causes of the observed differences.

Toumey and Neethling (32) show considerable differences between hemlock, Norway pine, white pine, and spruce.

Korstian's (15) experiments with oak seedlings indicated that resistance increased with age, and Bates (3) on rather inconclusive grounds likewise took this viewpoint. Toumey and Neethling also found that seedlings stood longer exposures to high temperatures without visible injury as the age increased.

There are, on theoretical grounds, a number of ways in which the plant may maintain its temperature at ground level considerably below the temperature of its surroundings.

TRANSPIRATION

Bates (3) found significant differences between species in the matter of heat resistance and explained them on the basis of relative transpiration between species, protection being attained by the cooling effect of evaporation. Work of such investigators as Ehlers (9), Mrs. Shreve (29), and especially Clum (5) seems to render such a hypothesis unlikely as they were unable to find that transpiration affected even broad leaves in fair winds to any notable degree. Much less would it affect stems without stomata where the cooling effect can only be due to the upward moving stream of water from the cooler soil layers.

To test the possibility of such an effect, two Douglas fir seedlings were selected and were heated for 15 minutes

TABLE 6

EFFECT OF STOPPING TRANSPIRATION STREAM ON BASAL STEM TEMPERATURES

Time minutes	Surface sand temperature ° F.	Internal temperature		
		Treated tree ° F.	Check tree ° F.	Difference ° F.
0	89	85	87	— 2
3	107	103	100	+ 3
6	122	112	112	0
10	137	121	124	— 3
15	148	127	129	— 2
				Avg. — 0.8
Treated tree topped and sealed				
0	114	105	107	— 2
4	128	120	118	+ 2
7	141	121	124	— 3
10	144	125	128	— 3
13	149	130	131	— 1
16	151	130	131	— 1
				Avg. — 1.3

to temperatures close to the danger point. The specimen which was later treated to stop transpiration averaged 0.8° F. cooler than the check tree, as shown by Table 6.

After this test, the first tree was treated by being cut off about 2 mm. below the cotyledons and the cut sealed with collodion. The cotyledons were then sealed back in place and the pair were again exposed to heating for 16 minutes. The treated specimen now averaged 1.3° F. cooler than the check tree, showing no evidence of the internal temperature at ground line being held down by the transpiration stream.

STEM MASS

Large bodies, of course, heat through more slowly than small, and conceivably large stems with their high water content and consequent high specific heat might be protected to a certain degree by the natural lag in warming up. To

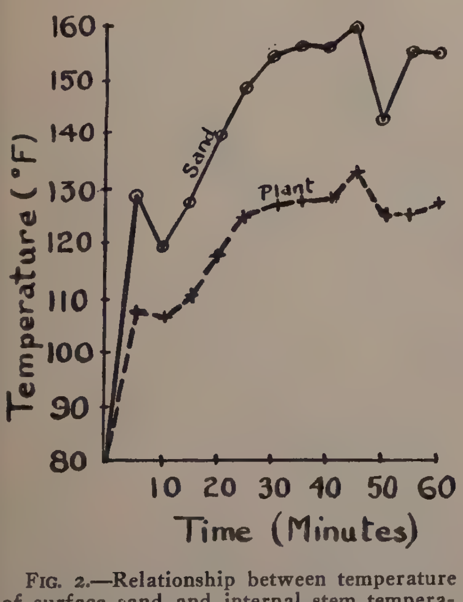

FIG. 2.—Relationship between temperature of surface sand and internal stem temperature of Coulter pine.

determine to what extent this might be true a specimen of Coulter pine was held as close to 130° F. as possible for an hour to see whether its relation to sand temperature lagged or was constant. Figure 2 shows clearly that the coolness of the stem is not due to a lag in temperature rise but to a very definite and sustained influence by which the plant is maintained at a lower temperature than the surrounding sand.

CONDUCTION AND RADIATION

That the heat received by the seedling stem is quite effectively dissipated is shown by Figure 2. To follow in detail the path of the losses is outside the scope of this study, and any discussion of the theory involved would be unprofitable, owing to the many unknown factors involved.

It is worth while to point out, however, that the seedling stem when heated intensely at a middle point where the sand layer touches it, and with relatively cool air or soil immediately above and below, is in much the same situation as a glass tube heated in a narrow flame. Every laboratory worker knows how quickly a small tube heats up under these conditions and how much slower the heating is with increase in diameter. The analogy is also close, in that the heat in both cases is concentrated on one side. This means little in heating a slender tube but with larger sizes the heating on the two sides is strikingly uneven. The same factors of radiation and conduction are at work in the two cases and go far to explain the differences indicated in Table 4, although, as pointed out, the correlation of size with resistance to internal heating is not extremely close.

SHADING

In most of the experiments mutual shading was carefully avoided—each tree stood alone—and with the broad source of heat, the 12-inch reflector plus sunlight, self-shading by leaves or cotyledons was considered negligible. During the latter part of the work, however, it was found that thermocouples placed in the sand 1-2 mm. south of the plant stems registered much lower temperatures than couples placed 10-20 mm. distant on the same side. If the tops were removed from the seedlings such an effect was much minimized, so that it was not entirely due to rapid conduction of heat from the sand to the cool plant stem. The true cause seems to be the shade cast by the tops even though it may be very slight. The effect of the shade factor is shown in Figure 3 by the temperatures of stems in various positions.

Seedlings best protected from heating are, therefore, those with large stems, many cotyledons, and short stems which bring the tops close to the soil, and those that make rapid development of true leaves above the cotyledons.

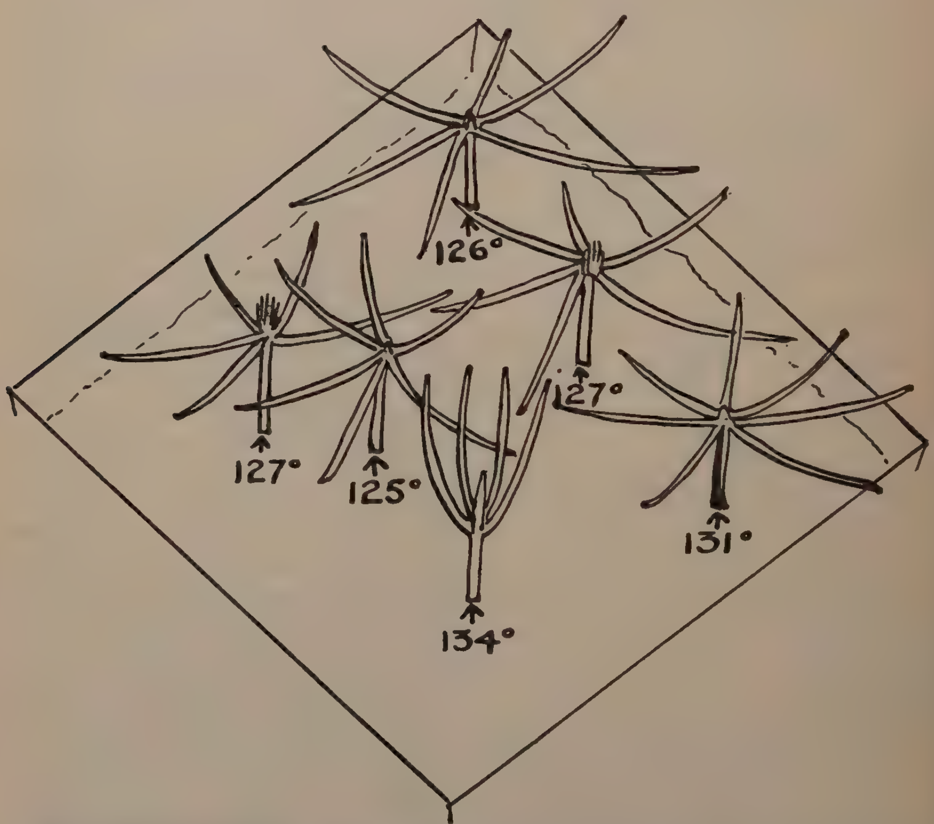

FIG. 3.—Stem temperatures in *Pinus attenuata* due to the effect of shade from cotyledons. The view is taken at an angle of 60°, *i. e.*, the angle at which the rays from the radiant electric heater were directed upon the seedlings.

Effect of Morphology and Age on Seriousness of Injury

Not only does the development and general morphology of the seedling bring about a certain degree of protection from excessive heating at the base, but it also has a very marked effect upon the seriousness of the injury once the danger point is reached, for one seedling may perish while another is only moderately injured by the same initial damage. Hartley (11) has pointed out that to all appearances, death ensues in slightly injured seedlings when fungi, of species unable to enter the uninjured stem, penetrate through the wound and involve the absorbing portions of the roots. At any event both he and Tubeuf (33) have noted the rapid development of fungi in heat-injured seedlings placed in the damp chamber, other than those involved in "damping off." Hartley also records the survival of several typically injured seedlings.

This suggests that the true cause of the sensitivity of very young seedlings, which has been noted by Bates (3), Toumey and Neethling (32), and Korstian (15), lies not so much in a specific protoplasmic sensitiveness (the improbability of this has already been discussed) as in a tendency for slight injury to be followed with very serious primary and secondary consequences, due to the succulence of the tissues.

The extent to which differences in age affect apparent resistance is shown in Table 7. In each test 6-10 seedlings usually were exposed to the heat although only two contained thermocouples. Records were kept on the injury to all seedlings, however, and the compiled results are here presented. Considerable variations in internal temperatures are certainly involved here and account in part for the results and the frequent inconsistencies.

When conifers germinate the first thing to appear above the ground is the "loop" of the hypocotyl. It has two means of conducting heat away into the soil, through the "root" and through the upper part of the hypocotyl to what remains of the seed, which may not be very deep in the soil however. The "loop" is rather quickly injured by heat on its upper surface and at ground level for it is open to the full heating effect of the sun. Fortunately it remains in this stage only a short period, one in which soil moisture even on the surface is high and the weather cool. The hypocotyl at this stage has the tissues of cortex and pericycle only slightly differentiated. Xylem is limited to small protoxylem strands; phloem is virtually absent, and the cells are succulent and thin walled. Heat injury causes a collapse of cell structure, extending down into the pericycle, and death follows quickly as a rule, for turgor is necessary in the "loop" to pull the cotyledons out of the seed. Also, the tissues are easily invaded by fungi at this time.

In the next stage the cotyledons either pull out of the seed coat which is left in the ground and the stem becomes erect, or the seed is pulled out of the soil and the cotyledons gradually work themselves out of the seed and drop it off. The stems at the beginning of this stage are quite succulent and in many pines have a plum-colored bloom upon them which may persist for some time. The epidermis, however, becomes heavier during this period through development of its cell walls and the endodermis like-

wise becomes more distinct. The xylem remains small, only a few metaxylem elements being added to the original bundle.

Until the cotyledons are spread there is no shade and damage to the stem by overheating is easy. With the development of the endodermis comes a tendency for the injury to be limited to the cortex, which collapses, while within the endodermis the cells maintain their shape. The seedling will usually lop over, and if it lies on the hot sand for any time death is rapid. In almost any case it is certain within a few days.

After the cotyledons are spread there appears to be a pause in growth above ground. Some seedlings, notably of the true firs, may do little more than form a bud. Others, especially those native to low altitudes and long seasons, continue to grow. Among the *Cupressineae* and *Taxodiae* secondary xylem begins to develop rapidly; among the *Abietineae* it comes more slowly. This gives stiffening that prevents lopping over and serves to reduce the injurious effect of basal construction from heat. At about this time, probably due to development

TABLE 7

AMOUNT OF INJURY TO SEEDLINGS OF VARIOUS SPECIES AND AGES AT GIVEN SURFACE SAND TEMPERATURES

Maximum sand temp. ° F.	Species [a]	Per cent injured		
		Young [b]	Medium [b]	Old [b]
125-130	Port Orford cedar	100	50	...
	Western red cedar	100	80	...
131-135	Coulter pine	0	0	...
	Monterey cypress	...	0	0
	Redwood	...	33	...
	Gowen cypress	100	44	0
	Grand fir	100	75	33
136-140	Monterey cypress	...	...	0
	Bigtree	100	25	60
141-145	Coulter pine	100	17	0
	Monterey cypress	...	50	48
	Grand fir	100	100	50
145-150	Redwood	...	100	...
151-160	Bigcone spruce	60	50	50
	Coulter pine	100	18	50
	Western yellow pine	100	90	50
	Redwood	...	90	...
	Douglas fir	...	100	...
	Maritime pine	...	100	...
	Western red cedar	...	100	100

[a] Species are arranged in the approximate order of their resistance to injury in each temperature range given in the table.

[b] Young—from appearance of the loop to casting the seed coat. Medium—from spreading the cotyledons to collapse of the cortex (browning of stem). Old—after steam has browned and "hardened" from collapse of cortex.

of the endodermis, the cortex suddenly changes. The outer cell layers under the epidermis develop thicker walls, the inner layers become disorganized, and the whole tissue collapses, distorting and flattening the cells. Macroscopically this change is marked by a browning of the stem, an obvious reduction in diameter, and the development of vertical fluting and wrinkling. When tested with the thumb nail the stem is no longer succulent, but rather hard and wiry. When this condition is reached the tree becomes decidedly more resistant to injury. There is no reason to suppose that the living cells of the cambium just coming into activity will not be killed at temperatures of 130° F. or so, but the injury is no longer marked by superficial damage to the external base of the stem nor is there much likelihood of serious fungous attack as the epidermis is not broken. The stem is also too stiff to lop over. After this stage is reached, a different kind of heat injury is to be looked for, a canker caused by killing the cambium as described by Korstian and Fetherolf (14), more like the familiar sunscald. The chance of the whole stem being involved and girdled decreases as diameter growth begins.

Species in Relation to Heat Injury

Not only does age affect the reaction of the plant to heat injury but specific characteristics also appear to play an important part in determining the fate of a seedling in a site exposed to intense insolation.

The largest of the species studied, Coulter pine (*Pinus coulteri*), has a stem about 2.5-3.0 mm. in diameter, rather firm and not very succulent even in youth. It sheds its seed coat rapidly, has a fairly short hypocotyl (20-30 mm.), and many long cotyledons (30-50 mm.), which shade the stem early in life. Indeed, it is so well protected that in order to produce serious basal injury a degree of heat must be used that usually kills also the bases of the first primary leaves, which are apparently not very well cooled owing to their crowded arrangement. Such intense heat must be very rare in nature. The size of the stem also prevents lopping over and usually restricts the injury to one side only. The stem changes from green to brown rather tardily. Obviously the tree is well suited to hot, dry sites.

Only a few seedlings of limber pine (*Pinus flexilis*) were raised and insufficient work was done with them to learn very definitely their characteristics. It appears, however, that the hypocotyl is short and hardens rapidly, and that the cotyledons are long, so that in all probability it should be regarded as second only to Coulter pine in resisting high temperatures.

Next in size is western yellow pine (*Pinus ponderosa*) with stems about 1.5 mm. in diameter. Very young seedlings are quite succulent with bluish or purplish stems. They gradually become a clear green, sometimes pink at the base, and about the time the primary leaves become 100 mm. or so long the stem turns a light reddish brown, shrinks, and hardens. The cotyledons are less numerous than in Coulter pine, averaging about ten. The tree is rather easily injured by heat in youth, but the stem hardens rapidly and lopping over is rare except in the youngest trees.

Maritime pine (*Pinus pinaster*) is much the same, although its stem hardens

more slowly than western yellow pine and consequently is susceptible to serious injury for a longer period.

Knobcone pine (*Pinus attenuata*) appeared and behaved very similarly to the maritime pine.

Bigcone spruce (*Pseudotsuga macrocarpa*) develops stout seedlings with hypocotyls averaging about 15 mm. long, and about ten rather long cotyledons (30 mm.). The stem changes from green to brown in an irregular manner, narrow vertical streaks of brown appearing here and there, gradually increasing and merging. The stem may remain green at the ground-level danger point for some time after general browning has taken place. The primary leaves are produced rapidly and wilt rather easily under extreme heat. The tree seems only moderately heat resistant.

Douglas fir (*Pseudotsuga taxifolia*) is next in stem size, though considerably smaller—about 1 mm. in diameter. The stem is usually red, rather tall, and the cotyledons 5-6 in number. The seedling is decidedly more easily injured than those already mentioned. The small stem is often completely girdled and the seedling lops over in most cases with fatal results. The first sign of injury at the base is a greenish spot on the red stem. When the cortex shrinks, the stem color change is not as marked as in green-stemmed seedlings, as it changes to a red brown at about the time the first leaves are 10 mm. long.

Lowland white fir (*Abies grandis*) has much the same development of the stem. Cotyledons are usually 4 and rather larger than in Douglas fir. Growth above the cotyledons was almost nil in the specimens grown in the laboratory, only a maximum of 8 small leaves being produced before growth ceased and a bud was formed. The stem is pink in youth while succulent, turning a red brown and becoming very dense.

With redwood (*Sequoia sempervirens*) the stem is about 1 mm. in diameter, bright red, tall, and remains succulent for a very long time. The endodermis is poorly developed, the core of xylem small, and the 2 (occasionally 3) cotyledons give little shade. As a result this species is very easily injured and the damage is usually fatal. Growth of the tops is rapid but comes without any notable hardening or strengthening of the lower stem. The seedlings lop over very easily at the slightest injury.

Bigtree (*Sequoia gigantea*) is somewhat smaller but behaves very similarly.

Monterey cypress (*Cupressus macrocarpa*) has a stem somewhat less than a millimeter in diameter and develops a large top very rapidly. The stem hardens very quickly at the same time, both through the compacting of the cortex into a "bark" and through the rapid development of secondary xylem. The danger period is acute while it lasts, for the seedling is frail and its cotyledons are small, but it passes through the danger period very quickly. The rapidly growing top usually wilts at about the same time as basal injury becomes evident, very likely due to excessive transpiration.

Insufficient work was done with Port Orford cedar (*Chamaecyparis lawsoniana*), Gowen cypress (*Cupressus goveniana*), and western red cedar (*Thuja occidentalis*) to trace their development and relationships to intense insolation. In extreme youth the seedlings are very tender, the stems small, and the cotyledons few. In the case of western red

cedar, however, the stems are short, which is some advantage.

Sitka spruce (*Picea sitchensis*), subject to a little study, shows succulent green seedlings with long top-heavy stems, and 4 narrow, small cotyledons. In this stage it perishes easily from basal injury.

In general it may be said that the following factors are most effective in preventing fatal injury by heat:

1. Many and large cotyledons, producing maximum shade.
2. Sort stems (hypocotyls) which bring the cotyledons closer to the soil and throw more shadow on the stem base and nearby soil.
3. Rapid development of true leaves.
4. Large stems, which localize the injury instead of permitting a complete encircling, and also reduce the tendency to lop over.
5. Rapid internal development of tissues (endodermis and xylem), preventing deep injury and developing stiffness.
6. Early degeneration of cortex from succulent to hard tissue, promoting stiffness and preventing open external lesions favorable to the development of fungi.

Summary

1. The living tissues of seedlings of representative conifers of western America (1-3 months old) are quickly killed when a temperature of about 54° C. (130° F.) is reached but can withstand a temperature only a few degrees lower for some time.
2. In nature, fatal temperatures are reached in seedlings only at the base of the stem, where for a few millimeters above and below the soil level, the living cells may be killed.
3. The heat injury ranges from mere discoloration on the sunny side of the stem to the complete killing of a whole ring of tissue, making either a light-colored or white spot or a complete constriction at ground level.
4. Heat injury is difficult to distinguish from "damping off." The edges of the lesion are more sharply defined in the case of heat injury, however, and the damage occurs under very different conditions.
5. Surface soil temperatures ranging from 130° to 160° F. have been repeatedly noted in temperate climates, especially in loose, sandy, and especially dark-colored soils, and injury has been noted with maximum temperatures as low as 120° F.
6. Seedlings grown in a soil with a dry, sandy surface remain generally under laboratory conditions at a temperature 15°-20° F. cooler than the surface sand temperature, although wide variations from these average figures are possible (max. 42°-min. 0° F.).
7. The temperature in the base of a seedling is largely influenced by the amount and position of the shade cast by the cotyledons and true foliage.
8. The degree of injury suffered by heat lesions varies with age, as the "hardening" of the stem tissues (development of epidermis, endodermis, xylem, and compression of the cortex) reduces the tendency to lop over and hinders the entrance of pathological organisms, which several investigators have indicated as the probable cause of death following only moderate injury.

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Livestock Husbandry on Range and Pasture. By Arthur W. Sampson, Associate Professor of Range Management, University of California, and Plant Ecologist, California Agricultural Experiment Station. *John Wiley and Sons, New York, 1928. Pp. xxi and 411, 116 illus.*

An understanding of correct management of the native forage on range lands and of the livestock grazing thereon is of vital concern to all who are concerned with the administration of such lands, with the development of sound land policies, or with the education of students in range management and forestry. Since about half the forest area in the United States is grazed, and since the National Forests not only occupy a strategic part of the yearlong range feed of the western livestock industry but their administration also serves as a practical demonstration of good range management, foresters are interested in the possibilities for improving management practices on range lands. Good management of livestock on the range is just as essential as good management of feed if the range resource is to be used and perpetuated consistent with other uses of the land, such as watershed protection and timber production on grazed forested areas, and if stockmen are to receive a fair return from their livestock production.

This book is the third volume of a series on range management which Sampson has prepared for the student and practical stockman. In " Range and Pasture Management " the main principles underlying the management of range forage were presented. This was followed by " Native American Range Plants " giving the characteristics and main features influencing the value or lack of it of many important western range plants. " Livestock Husbandry on Range and Pasture " views the range problem largely from the livestock standpoint. The author has brought together in this one book an interpretation of the published material on livestock and its management together with his own observations on the problem. The subject matter is divided into four parts.

In part one a brief history of the livestock industry and suggestions for improving domestic livestock are given.

Part two outlines for sheep the main characteristics and adaptability to range and farm of the leading breeds; how sheep may be judged; the more approved practices for their handling and management on the range; other important husbandry matters on range and farm; and the more important diseases with suggestions for prevention and treatment. It also discusses seasonal use of range and the handling of livestock in conformity therewith, illustrating how it applies to the Wasatch Mountains of Utah. One chapter is devoted to the production of goats on range and farm.

Part three treats the management of beef cattle on range and farm in a man-

ner similar to that for sheep and goats.

Part four discusses cost accounting and budgeting in livestock production. It also describes and suggests methods for control of animals which prey upon livestock and of rodents that destroy range forage. One chapter is devoted to wild animal life and recreation areas and their relation to livestock production, and another to reindeer production in Alaska.

The book reads easily and freely and supplies a general foundation for the phases of livestock production covered. The author has wisely included a bibliography of some of the more important published material on each phase at the end of the respective chapters. With such a comprehensive field it has been impossible to treat all phases in the detail and adequateness that the range phases would appear to justify. To the reviewer it would have seemed more appropriate to have left to animal husbandry texts much of the discussion intended for farm application, except as it is a part of the yearlong range problem, and have used that space for a more adequate and more specific discussion of the range managements phases. Although the author has numerous references to literature consulted, additional references appear to be justified.

While the author states that the book is intended principally for instructional purposes, its use as a complete text in general animal husbandry training of range management students in place of the more adequate animal husbandry courses usually available in agricultural colleges would not appear advisable. Those phases which refer specifically to livestock management on the ranges can be used to good advantage as supplemental to the regular animal husbandry courses. For those who have not had some animal husbandry training the entire book should hold much of interest. Therefore, by foresters particularly, but also by range management students and range stockmen, this volume which brings together the main features of livestock husbandry on range and farm will be accepted as a valuable contribution to the literature.

W. R. Chapline.

Physikalische Eigenschaften von Wald und Freilandboden. (Physical Properties of Forest and Non-Forest Soil.) By Hans Burger. *Reprint from Mitteilungen der schweizerischen Centralanstalt für das forstliche Versuchswesen XV Band, 1 Heft. Zürich, 1929.*

This investigation was an outgrowth of the disastrous floods which occurred in September, 1927, in eastern Switzerland. The author shows how proper reforestation coupled with engineering work can control floods by preventing rapid run-off, checking erosion and landslides, and hindering snow slides.

A considerable part of the study deals with the properties of forest and non-forest soils. Soils in mature coniferous forests were found to take up 63.6 per cent of their weight in water, while soils taken from a grass-land type were able to absorb only 8.8 per cent. The pore volume of forest soil was 74.4 per cent as compared with 58.7 per cent for soil taken from a non-forested area. Experiments on the effect of forest cover on permeability show that forest soils absorb water 6 to 70 times as rapidly as soil taken from pasture land.

The larger water capacity, pore space, and permeability of forest soil greatly influence run-off. By checking the force of the precipitation and allowing the water to percolate slowly through the soil instead of running off, forest areas are particularly effective in checking erosion and the silting of streams. Swiss research workers recognize that forests are beneficial in this respect, but that the effect of forests on the total discharge of a large stream is negligible. This principle might be kept in mind in our own Mississippi flood control project.

The author also stresses the fact that a thorough knowledge of plant successions should be obtained before reforestation is attempted. It is pointed out that reforesting small areas is useless while large stands of existing forests are improperly managed.

A number of conclusions are reached, some of which are not new:

1. Properly managed forests play an important rôle in flood control by decreasing run-off and checking erosion.

2. The protective purpose of reforestation cannot be fulfilled in a pure spruce stand because optimum soil conditions cannot be brought about, and therefore the favorable action of the forest on run-off is considerably lessened. The formation of sour humus under pure spruce stands leads to gradual deterioration of the soil.

3. Forests should be established and managed in such a manner that optimum soil conditions are obtained as soon as possible and retained permanently.

4. Road construction and proper management of the forest, coupled with engineering works, are absolutely essential if forest land is to produce the highest possible net income.

5. The action of forests on run-off is greatly influenced by the geological formation of the soil; therefore effects of forests of the same area in different watersheds on run-off, erosion, and flood control are not greatly comparable.

6. Local effects of reforestation are more noticeable and favorable than effects on flood discharge of large streams.

7. The forest is not capable of stopping avalanches completely, but can hinder them to an appreciable extent.

8. Well-managed forests are limited in their effects on site, floods, and erosion. However, proper management coupled with engineering works can reduce considerably the effects of ordinary high water stages of large streams.

JOE STOECKELER.

The Native and Naturalized Trees of Illinois. By Robert Barclay Miller and L. R. Tehon. *Division of the Natural History Survey, Volume 18, Article I, Urbana, Illinois,* 1929.

This bulletin is a welcome contribution to the present knowledge of the trees of Illinois. Following keys to the trees for the four seasons by William Trelease, the authors present an individual treatment of ninety-four species and three varieties. The botanical names are those given in the second edition of Sargent's "Manual of the Trees of North America." The common names are also given largely on the same authority. The ninety-eight full-page plates and the many excellent figures make the publication a very attractive one.

Maps indicate the distribution of the species by counties. Although the intro-

duction states that every species may not be recorded for each county and that the occurrence in adjoining counties may be taken to mean that a species may be found in the county in question, provided suitable habitats exist, some of the omissions seem rather large and significant. For example, no trees are recorded on the maps for Montgomery County, although the southern part of this county is actually situated in a "wooded" section of the State. Several portable mills have operated here. In addition to the willows, the following trees may be added to the distribution maps from this one locality:

Juniperus virginiana, Populus balsamifera var. *virginiana, Juglans nigra, Carya cordiformis, C. ovata, C. alba, Betula nigra, Quercus borealis* var. *maxima, Q. velutina, Q. marilandica, Q. imbricaria, Q. macrocarpa, Q. stellata, Q. alba, Ulmus americana, Celtis occidentalis, Asimina triloba, Sassafras officinale, Platanus occidentalis, Amelanchier canadensis, Prunus americana, P. virginiana, P. serotina, Cercis canadensis, Gymnocladus dioicus, Gleditsia triacanthos, Robinia pseudacacia, Acer saccharum, A. saccharinum, Aesculus glabra, Tilia glabra, Diospyros virginiana, Fraxinus americana.* Undoubtedly there are additional trees in this county which are not mentioned.

The authors are to be congratulated on this work which should encourage a widespread interest in the tree distribution of Illinois. It is to be hoped that they will continue to collect information about the distribution of trees in the State and that the new records obtained will warrant an early revision of an already excellent publication.

D. V. Baxter.

Zytologische Untersuchungen an einigen endotrophen Mykorrhizen. (Cytological Investigations of Certain Endotrophic Mycorrhizae.) By Joh. Justus Arcularius. *Centralbl. f. Bakteriol., Parasitenk. u. Infekt.-Krankh. Abt. II. 74: 191-207. 14 fig., 1 pl. 1928.*

The biologic and physiologic significance of mycorrhiza of forest trees has received considerable attention during the past few years. The work of Arcularius on the endotrophic mycorrhiza of *Myrica gale* and *Alnus glutinosa* should be of particular interest, especially to foresters, because certain species of these genera are rather widely distributed in American forests and to these species, due to the presence of nodule-forming organisms on the roots, has been attributed the ability to increase the nitrogen content of the soil.

The author found that in the beginning of the mycorrhizae of both *Myrica gale* and *Alnus glutinosa* filamentous fungi are present. These develop rather rapidly, eventually forming dense, ball-like structures in the cells. These structures are later digested by the cells resulting in a more or less homogeneous gelatinous mass.

During the early and latter stages of this digestion, bacteroidal bodies are commonly found in both *Myrica* and *Alnus*. Often they fill the entire cell. These are quite similar in form to those found in nodules on the roots of the *Leguminosae*.

No evidence was found in spite of diligent search which would indicate that these bacteroidal bodies are produced by the mycorrhizal fungus, and it appears that they are distinct and separate organisms.

The author believes that these symbiotic bacteria, similar to those occurring in the *Leguminosae* rather than mycorrhizal fungi, may explain the fixation of nitrogen reported by Hiltner[1] in *Alnus*.

HENRY SCHMITZ.

Test of Scandinavian Gang Saws on Pacific Coast. Report of the Sub-Committee on Gang Sawing of Lumber of the National Committee on Wood Utilization, Department of Commerce, Washington, D. C. *Report 14 (mimeographed) of a series on the marketing and use of lumber. 1929.*

This report describes a most interesting experiment which is now being carried out on the Pacific Coast.

The excellence of the manufacture of Swedish lumber is well known throughout the world, so well known that all Swedish lumber is branded in order to protect that reputation. This lumber is cut with gang saws which are very economical in the use of labor and particularly effective in the handling of small timber.

All these advantages combine to recommend this practice for the utilization of small top logs in the Douglas fir region, where it has been found unprofitable to bring logs out of the woods to be manufactured by the old methods.

The Scandinavian practice involves the use as a head saw of a fast-feed gang jig equipped to saw round logs, with special carriages for feeding in the log and taking away the lumber. With such equipment, a continuous procession of logs can be passed through the gang by two men, one to feed the log in, the other to take the lumber away.

The saws are set in a pattern to cut both boards and dimension from a certain sized log, the logs having been previously sorted to size in the mill pond. When a single gang is used, the log is sawn alive and all the lumber is dumped mechanically on to the edger transfer. When two gangs work on the same logs, the first slabs the log on two sides, at the same time cutting off one or two boards; the second gang saws the remainder of the log into square-edged boards and dimension material. Only a small portion of these products has to be edged. The capacity of the two gangs, working in this way, is about 70,000 feet per day.

From the viewpoint of the forester, however, or even from that of the lumber industry, it may not in the long run be altogether an unmixed blessing. This device for wringing a profit from small logs will undoubtedly drag on to the market a great deal of second growth which might better be left in the woods to grow to larger sizes. There will be the same difference that there was between the early pine operations in the East, which took out only the larger trees and left the smaller stuff for a second cut, and the later operations which cut clean and left only brush in their wake. It is, nevertheless, an experiment well worth a trial.

The advantages of this set up are many. Small logs which cannot profitably be handled with circular or band mills can be made to pay because: (1) The gang produces from 15 to 25 per

[1] Hiltner, L. Über die Bedeutung der Wurzelknöllchen von *Alnus glutinosa* für die Stickstoffernährung dieser Pflanze. Landw. Versuchsst. 46: 153. 1896.

cent more lumber from the same logs; (2) the man labor involved is only one-half to one-third that needed in the old practice; (3) no skilled labor is needed; (4) accurately sawn lumber is produced; (5) waste is greatly reduced and timber conserved.

The only apparent disadvantage from the manufacturer's viewpoint is the reduced speed of the operation, and this is not such a serious drawback. The present tendency in all American sawmill operations is a sacrifice of speed for an improvement in quality.

This innovation seems to have considerable promise and may do much to reduce the waste in the lumber industry.

E. G. Cheyney.

Factors Affecting the Cost of Tractor Logging in the California Pine Region. By M. E. Krueger. *University of California, College of Agriculture, Bull. 474. Pp. 44, tables 22, figures and graphs 11. 1929.*

This particularly useful and very practical piece of work reflects the author's wide experience in logging engineering work.

Tractor logging, where feasible, has such important advantages over earlier systems that with some companies it has very quickly become almost the sole method of transporting the log from stump to landing. The author reports that in 1928 "probably not less than 60 per cent of the timber output of this (California pine) region was yarded with tractors of the track-laying type." As a result, there are many donkey engines begging for a purchaser, another indication of modern rapid obsolescence of methods and equipment.

Time studies of ground skidding showed that "it costs approximately three times as much per M.B.M. to skid (16-foot) logs averaging 18 inches in diameter as those averaging 48 inches in diameter. . . . . When it is considered that these logs represent only 8 to 29 per cent of the volume but 20 to 48 per cent of the total cost of skidding, it is evident that some thought can well be given to the question of selective logging." The reviewer wishes the author had enlarged somewhat on this latter phase, because there is danger that that popular term may come to mean something which it should not. Selective logging is nothing but additional waste if it does not include the protection of the smaller trees for a future cut. Also, if logs of 18-inch diameter cost three times as much to yard as logs of a 48-inch diameter, there is danger that such small logs will be left in the woods with the tops and branches, certainly not a good measure from a conservation standpoint, or business either, because leaving those logs involves losses not covered by yarding cost considerations alone.

The size of the load also was found to have a very important influence upon ground skidding costs. "In all studies the cost per thousand board feet for skidding loads of 200 board feet is approximately eight times that for loads of 2000 board feet. The size of the load is in itself the important element as the average trip time remains fairly uniform, being only 15 per cent greater for a load of 2000 board feet than for a load of 200 board feet, while the cost is decreased 90 per cent."

Here and elsewhere the author calls attention to the importance of proper organization as an important influence upon costs. Naturally there must be close coördination of the efforts of men and equipment, otherwise there are uneconomical delays and equipment tie-ups.

In studying the effect of slope the author found that "slopes of 10 per cent to 30 per cent in favor of the load are ideal, since they permit a large load to be handled with ease and still do not greatly increase the 'out' travel time. Because of the large increase in cost of skidding on adverse slopes it is undoubtedly good management to secure such a layout of railroads as will permit skidding only to the upper side of the track for slopes averaging greater than 6 per cent."

The author furnishes a table and graphs showing the effect of yarding distances of from 400 to 3000 feet for different railroad costs, and densities of stands, and illustrates by diagram and computations how yarding distance and railroad mileage affect the problem. Another table gives data on daily tractor output for various conditions of distance and density. The output is reported to vary all the way from 18,430 board feet for timber averaging 4 logs per thousand and skidded 3000 feet to over 47,000 feet for timber averaging 1.5 and 2.5 logs per thousand and skidded only 400 feet. A consideration of daily output is "of importance when balancing the logging operation with regard to number of tractors and their coördination with loading equipment."

In the case of big wheel yarding an additional factor must be considered—"bunching" the logs preparatory to the arrival of the tractor. This bunching cost constitutes a very appreciable percentage of the yarding cost, especially in small timber. "The outstanding factor of bunching cost is the number of pieces handled per bunch. No great difference in time of handling was noted for pieces of 100 board feet as compared to pieces of 2000 board feet. . . . . The important element is, therefore, the average time per piece which in this case was found to be 4.21 minutes. The high cost of bunching small timber is consequently due to the large number of pieces required to make a load, since the cost of bunching is in direct proportion to the number of pieces handled. This is of the utmost importance to operators who must buck their timber in 16-foot lengths in the woods."

"The effect of load is even more pronounced in wheel yarding than in ground skidding. With the lack of friction, due to the load being supported, load has less effect on the time of the average trip. . . . . The trip time for a 3400 board feet load on an average is increased only 9 per cent over that for 600 board feet, while the cost per thousand board feet is decreased 81 per cent. . . . . The cost of wheel yarding logs is not influenced to such a great extent by slope as is the cost of ground skidding. With a supported load, the size of allowable load is not affected to as great a degree by variations in slope. However, there is still an increase of the cost with decrease of favorable slope and increase of adverse slope. . . . . Distance has the same general influence on cost of yarding with wheels as on cost of ground skidding. The increase in cost with increase in distance is not as rapid, however, due to the larger load handled."

The use of tractors has worked a profound change in the appearance of logged-off lands. In fact the considerable saving of unmerchantable trees due to their use has prompted some operators to remark that they are practising forestry. While this saving of small trees is purely incidental to the tractor method of logging, some operators are going to the trouble of instructing their tractor drivers to avoid young growth wherever possible. Regarding the use of tractors in forest management the author says: " No one development of recent years has been so readily applicable to selective logging as tractor yarding; whether such selective logging be for the purpose of taking out only the commercially valuable species or to promote sustained yield management. This applicability is due to the ease with which tractors can go around obstacles and to the absence of such special rigging charges as occur in the placing of auxiliary bull blocks, in order to practice selective logging with donkey equipment. Two common demands of good forestry practice in tractor logging are the holding of tractor travel to well defined skidding trails and turn-out places and the avoidance of choking two logs at ends adjacent to the same cut."

EMANUEL FRITZ.

Progress of Forestry in Hawaii. By C. S. Judd. *Report of the Territorial Forester to the Board of Commissioners of Agriculture and Forestry for the biennial period ending Dec. 31, 1928. Pp. 17-41. Honolulu, Hawaii. 1929.*

In his report for the calendar years 1927 and 1928, C. S. Judd, the territorial forester, emphasizes the increased activity in tree planting on the forest reserves made possible by larger appropriations. The greatest value of the Hawaiian forests is as a protective cover on the watersheds of the streams that feed the irrigation ditches of the sugar cane plantations. The native forest is subject to injury from many sources. The basic idea in this reforestation effort is to restore and maintain a complete cover.

So far as practicable trees with wind-borne seeds are used, or those attractive to birds, so as to favor natural regeneration. In the endeavor to find the trees best adapted to the various sites and soils a large number of species is being tried—over 235 in this period. During the biennium 418,531 trees were planted, double the number in the previous period. Spaced 15 x 15 feet, the area covered was 2157 acres, divided between 33 localities.

The native koa (*Acacia koa*) made up about one-tenth of the number set out; paperbark (*Melaleuca leucadendron*) another tenth. Silk oak (*Grevillea robusta*), Cook pine (*Araucaria cookii*), Australian red cedar, and American cypress and white ash constituted together about one-third of the total. A table lists the common and scientific name and the number of all species planted.

An interesting side light is a note on the results of sowing tree seed from an airplane. In March, 1928, Assistant Forester L. W. Bryan found growing trees of *Melochia indica,* the seed of which he had scattered from the air in July, 1926. The area was a burn on the Panaewa Forest Reserve on the Island of Hawaii. In a half-mile unit 24 indi-

vidual trees were found, ranging in height from 3 to 10 feet, with one specimen of another species.

The territorial forest nurseries produce about half a million trees a year. Fifty-two per cent are distributed under the terms of Section 4 of the Clarke-McNary act. Forest plantations established by the sugar companies are being increased by about a million trees each year.

The forest reserve system was extended by 63,705 acres, bringing the total area of all the reserves up to 980,682 acres. Of this, 64 per cent is land owned by the territory. It is expected that the total will soon be one million acres, which is almost one-fourth of the total land area of the Hawaiian Islands. A majority of the owners of the private land within the reserves coöperate with the territory in its management.

To protect the forests from grazing stock 42 miles of fence were built or repaired and an active campaign waged against the wild stock within the reserves: goats, sheep, pigs, and the few remaining wild cattle.

Since July 1, 1927, an executive officer, appointed to look after the routine work of the several divisions of the Board, has relieved the territorial forester of this duty and given him more time for his regular work. With him the staff now consists of four assistant foresters, a forest nurseryman, and seventeen forest rangers. Close coöperation is had with the forestry division of the Hawaiian Sugar Planters' Association. Altogether the report shows that steady progress is being made in forestry in Hawaii, along sane lines.

Ralph S. Hosmer.

The Willow Scab Fungus (Fusicladium saliciperdum). By G. P. Clinton and Florence A McCormick. *Connecticut Agric. Sta. Bull. 302, March, 1929. Pp. 25, pl. 8.*

This bulletin describes a serious fungous parasite of willow trees which in the past two years has been found in northwestern Connecticut, eastern New York, and portions of Massachusetts, New Hampshire, Maine, New Brunswick, and Nova Scotia. The disease has been known in Europe for many years, but was first found in its parasitic stage in North America in 1927. The authors have no fixed opinion whether this fungus is native or introduced, but state that serious outbreaks of the disease seem to be confined to vicinities where willows have been planted as shade trees, indicating that its introduction into America may have been on foreign stock. It is not yet certain whether the disease attacks all species of willow or not, but the authors state that there is at least some difference in the susceptibility of the different species, and that *Salix alba* seems to be resistant in America, although reported infected in Europe.

The disease first kills the young leaves, and finally the young stems; the more mature leaves are spotted and cankers are produced at the base of the infected leaves. The trees are defoliated shortly after attack and some of the branches die. After several years of more or less complete defoliation, the trees are weakened and succumb either to the direct action of the disease, or to starvation or winter injury. The authors state:

"We have seen no fungous disease of trees where the injury has been so sudden and severe as from this fungus, though the chestnut blight and the white pine

blister rust in the long run cause more serious financial loss and eventually just as serious injury to the trees.

"The fungus carries over the winter on the young twigs infected the previous year. In the spring the Fusicladium stage appears on these and the spores are washed down on the very young leaves in the opening buds, so that their death may occur before they have reached any size, much as occurs with the leaves of the sycamore from the anthracnose fungus. Some young leaves, however, escape infection only to succumb later. If the moist favorable weather continues, nearly full grown, or even full grown leaves may suddenly rot on the trees and adhere there for some time, presenting a very mournful sight. They then dry up and gradually fall off leaving the trees more or less defoliated. Bad defoliation two or three years in succession seems to be fatal since after the first year, little adventitious foliage is put out and gradual starvation results."

S. B. Detwiler.

State Forests in Hawaii

Honolulu, Hawaii,
November 13, 1929.

Prof. H. H. Chapman,
Yale Forest School,
New Haven, Conn.

Dear Chapman:

I have just read your excellently compiled article, "National and State Forests," which appeared on pages 622 to 655 of the Journal of Forestry for October, 1929, and wish to compliment you on the skillful manner in which you have directed attention to the question that will come up in the future, sooner or later, viz., acquisition of forest lands by the several states.

In studying the article, I was disappointed not to find a single reference to Hawaii. Just because we happen to be called a territory and to be separated from the states on the mainland by 2,100 miles of salt water, we do not feel that we are any the less an integral part of the United States and we are proud to head our letters Honolulu, Territory of Hawaii, U. S. A.

Aside from New York and Pennsylvania, Hawaii has a greater area of organized state forests than *all of the other states*. We now have a total area of 980,682 acres in our organized state forests on the five main islands, of which 626,049 acres, or 64 per cent, is owned outright by the Territory. The balance of 354,633 acres, or 36 per cent, is privately owned; but this is either turned over to our care for a period of years or is so thrown in together with the government lands that it is virtually under the Territory's organized administration. Additions are constantly being made to our state forests and before the end of the year they are almost sure to exceed one million acres, which will represent approximately 25 per cent of our total land area.

Please accept this not as a protest but as a friendly plea not to make an outcast of Hawaii and leave her out in the cold western world, but, whenever possible, to embrace her and take her into the forestry fold. On the showing indicated above and in many other ways, I think she is entitled to this consideration.

Very sincerely yours,
C. S. Judd,
Territorial Forester.

Bringing the Forest to the Folks[1]

Highway planting, once considered a frill or fad, is now taken seriously. Tree-lined roads we will have, and the way to the forest will thus have at least trees, if not forest trees. Recently in Pennsylvania some miles of an important highway were planted, but alas, with painfully inappropriate oriental planes. I asked my good friend, the then chief forester of the state, the inevitable

[1] From a paper presented at the Third New England Forestry Congress, Hartford, Conn., February 1, 1929.

"Why?" He ruefully admitted that it was because the trees were cheap. But the highways themselves are not cheap. In Pennsylvania they cost over rather than under $10 a running foot. Planting cost is a mere trifle in relation to construction cost.

The way in which the road can bring the forest to the folks as well as take the folks to the forest is to have the borders reflect the flora of the land through which it passes. How can I emphasize the necessity for this sort of treatment? Only by contrast with the present roads, mostly decorated with plenty of trees dead and strung with electric wires. I will ask you to bring back the laurel and the rhododendron that might be there while you contemplate the thistle and the burdock and the few things that survive the scythe of the road supervisor.

To enjoy the picture to its full there ought to be provision for the use of legs, now quite effectively penalized by motor vehicles. How vastly interesting the tree and plant-bordered highway will become as it is penetrated by footways, not necessarily at the grade of the highway, but winding through the right-of-way to obtain at times shade and shelter, and at times to give access to some prosperous tree or beautiful shrub. Then the journey between farm and farm, or suburbs and open country, or even from town to town will become a delight.

But there must be other provisions along this forest-decked way to the forest. Motors need gasoline, and sometimes repairs. Mankind seems to need "hot-dogs," which in combination with advertising signs make our main highways simply "one d—— filling station after another," fenced in by billboards.

We must reckon with this condition in better humor than my last words might predicate. We may not overlook stomachs any more than legs. It is a pleasure to report that Mrs. John D. Rockefeller, Jr., more than a year ago, provided the Art Center of New York with $5000 for prizes to the best-looking hot-dog stands. There were 700 entries, and prizes were awarded for the least ugly. Then commerce suddenly acquired enlightened common sense, and the man whose concern provided most of the frankfurters for the stands discovered that the good-looking ones free from signs and trash attacted the most people. Whereupon he provided $10,000 more to continue the effort. Recently Mrs. Rockefeller convinced Julius Rosenwald to experiment with selling at cost Sears-Roebuck ready-cut hot-dog stands, designed along several excellent models. It may therefore come about that relatively unobjectionable refreshment stands will come into existence. This will need careful guidance and the continual provision of good models because the average person who sets up a hot-dog stand lacks artistic standards.

What about the main desecrators of these highways to the forest, the advertising signs which, taking advantage of the vast public expenditures for improved highways, use them for commercial advantage to the destruction of natural beauty? Well, there is hope there also. The associated billboard interests, in at least one of their several large ramifications, have undertaken to remove objectionable billboards from scenic locations. They have shown respect for an irritated public sentiment, which if not heeded will tend toward the complete abolition of outdoor advertising.

There is a very powerful weapon which reasonably used will help to rid the roads of these intrusions. Obviously,

with another ten million motor cars added to the more than twenty million now traveling our highways, it will be even less possible to absorb the messages of these signs while driving safely to say nothing of the way in which the signs distract attention from the necessary information provided by public authorities as to safety, directions, and distances. If, as has been suggested in Pennsylvania, all advertising signs visible from any public highway be permitted to remain only as license is obtained from the state highway authority, who is instructed to license none that interfere with public safety, a great many signs will come down.

This would not involve the total abolition of outdoor advertising. There is no objection to segregated, restricted areas where small, well-considered advertising signs might be displayed in such agreeable fashion that the motorist would slow up to get the message. However, I have never found a community willing to have its immediate environs thus decorated, even in this intensive and careful fashion. Curiously enough, I have never found an outdoor advertising man willing to have billboards within any reasonable distance of his own home. It is also a commentary on the outdoor advertising business that many in it seem to regard their wares as suitable to be advertised on out-houses and decrepit buildings.

Another great weapon as yet inadequately used is direct, courteous remonstrance to the concerns represented on the advertising signs. Few business men will continue this form of advertising in the knowledge that a considerable number of citizens are angered by it. No department store in any city would persist in a display which aroused the sort of feelings we constantly note relating to highway signs.

In addition to the replanting of the forests, we must make the highways which connect them remind us of the forest, give us modern approximations of its ancient beauty, provide opportunity for that quiet contemplation which only the foot traveler may have, and reduce to a minimum the parasitic excrescences which unchecked commerce has too considerably permitted to grow upon our public roads.

J. Horace McFarland.

Titanium Tetrachloride for Kiln Smoke Tests

Titanium tetrachloride ($TiCl_4$ is the chemical used by the Army Air Corps for smoke screens or curtains. Its success in this use prompted the writer to try it out as a smoke-making material for the study of circulation in lumber dry kilns. At his suggestion, and for a test on a practical scale, Mr. Otto Springborg, dry kiln specialist of the Pacific Lumber Company at Scotia, California, obtained a small quantity and tried it out in his kilns. It proved satisfactory in every way. Not only does it produce a dense and sufficiently permanent " smoke," but its vapor is not harmful to body tissues in the quantities used and for the length of time the kiln operator is exposed to it. Mr. Springborg, Mr. F. L. Cobb of the Moore Dry Kiln Company, and the writer exposed themselves to heavy doses of the " smoke " in a cold blower kiln for over an hour without ill effects at the time or later. It may be advisable, however, for very long exposures in a natural draft kiln for the operator to equip himself with a simple mask, such as the old

style war-time gas mask, to filter out the smoke. However, an operator cannot remain in a heated kiln long anyway on account of the high temperature.

Titanium tetrachloride is a liquid and can be purchased in small quantities from the larger chemical houses. It costs about $3 per pound in one-pound lots, or $2.35 per pound in ten-pound lots. It has, however, recently been bought for as little as $1 per pound in five-pound lots. It is highly volatile and vaporizes immediately upon exposure to air. The vapor is thick and smoke-like and consists of titanium tetrahydroxide and hydrochloric acid, the former being the denser of the two. The latter is really in the form of tiny globules held in suspension and is not concentrated sufficiently to injure the operator. This "smoke" is slightly heavier than air, not enough so however to interfere with its effectiveness to study circulation currents, as the slightest air movement causes it to be visibly disturbed. On a still day it was found to respond readily to the relatively weak natural currents occurring around "stuck" trucks of lumber under a dry kiln shed.

This chemical comes in glass bottles. It is somewhat corrosive to steel and fabrics in its liquid form but not as smoke. In use, it may be placed in shallow dishes at the points in a kiln about which currents are to be observed, or a long rod of small diameter may be dipped into the liquid and then held toward the points or between the courses of lumber to be studied. The end of the rod should be fitted with a rag swab to hold enough of the liquid for several minutes of smoke production.

Smoke tests are valuable aids in determining the direction and uniformity of circulation in a kiln and in discovering "dead" spots and short circuits. In the simple trial test above mentioned, it was quickly demonstrated how the perfection of piling affected circulation, and, consequently, drying efficiency. It also suggested the proper location of baffles to give the circulation a more effective distribution.

These are only a few of the many benefits to be derived from smoke tests. No operator of dry kilns should attempt to conduct lumber drying without a thorough knowledge of how the air actually circulates within his kilns. With titanium tetrachloride, circulation tests can be made cheaply, quickly, and with no danger to the operator or injury to the lumber kiln. It is simpler to use than the smoke-making materials which are at present the standard, and does away with the inconvenient holder and tube now necessary.

Emanuel Fritz.

Reforestation and the Bureau of Internal Revenue

The Information Service of the National Lumber Manufacturers' Association has issued a press release dated Washington, August 13, under the caption "Internal Revenue Bureau Ruling Works Hardship to Reforestation." This article quotes a ruling of the Bureau of Internal Revenue (General Counsel memorandum 6544) to the effect that expenditures incurred in establishing forest plantations must be treated for income tax purposes "in accordance with their inherent nature, as capital expenditures." It states that the Bureau of Internal Revenue "has placed another taxation obstacle in the path of reforestation," and implies that, were it not for

this ruling, lumbermen engaged in reforestation projects could afford to disregard compound interest on planting costs. A careful analysis of the situation does not confirm these conclusions.

In the case ruled upon, the "M" Company had decided to embark on a reforestation program involving tree planting. To arrive at such a decision intelligently, the company had to choose between putting the money into tree planting, bonds, or some other investment or business enterprise, assuming that it did not want to pay it out in dividends. To compare from the standpoint of financial returns the investment in reforestation with any other prospective investment of the same money, it was necessary for the "M" Company to use compound interest. If the company had succeeded in treating its planting costs as current expense for income tax purposes, it would thereby have reduced its taxable income by the amount of those costs, and saved a corresponding part of its income tax. In that case it would have been fair to consider that the investment in planting had been subsidized by the amount of the tax saved, which at current corporation tax rates would have been 12 per cent of the costs in question. Therefore in comparing the reforestation investment with other investments, the company would have been justified in deducting this 12 per cent from the initial costs of reforestation, but could not have neglected compound interest on the remaining 88 per cent. An incorrect treatment of the total costs of reforestation on the books of the "M" Company, even if allowed for income tax purposes, could not possibly have changed the inherent nature of the transaction and have transformed a capital expenditure into anything else. Neither could such treatment, if allowed, have been in fact anything but exemption from income tax of otherwise taxable income to the extent of such amounts as might have been invested in forest plantations. There is nothing in the Revenue Act governing the income tax which would warrant the allowance of such an exemption.

The charge that the Internal Revenue Bureau "has placed another taxation obstacle in the path of reforestation" boils down, then, to the fact that the income tax law does not subsidize reforestation by means of tax exemption. If the law were changed so as to allow the treatment of forest planting costs as current expense, it would subsidize only such reforestation projects as are carried on by those corporations or individuals with current taxable income to be reduced by expenditures for these projects. In the case of individuals, the progressive tax rates on income would make the subsidy larger for those with higher incomes. Though some form of government subsidy may be desirable to encourage reforestation, it would not seem wise to grant it only to recipients of taxable income, and in proportionately higher amount as the income of the beneficiary is greater.

It should be added that in the case of a forest so organized that an approximately equal quantity of timber is cut each year, and a corresponding area replanted each year, it might be proper accounting to treat the cost of planting as a maintenance expense, and charge it off annually. In such case, however, there would be no annual charge for depletion of timber, as the total timber capital in the forest would remain un-

changed. It is not likely that the question has yet arisen of income tax accounting under these circumstances.

R. C. HALL.

PLANS FOR THE PENNSYLVANIA STATE FOREST SCHOOL

The new "Pennsylvania State Forest School" which has resulted from the merger of the two forest schools of Pennsylvania, the Pennsylvania State Forest School at Mont Alto and the Department of Forestry at the Pennsylvania State College, will make use of both plants in the training of professional foresters and forest rangers. Freshmen foresters and two-year ranger students will study at Mont Alto, as will also senior foresters during the last two months of their course. Otherwise the sophomore, junior, and senior years will be at State College. Fifty-five freshmen forestry students and sixteen ranger students were admitted to the Mont Alto plant September, 1929, and will remain there until August of the next year.

The plan of educating foresters in the Pennsylvania State Forest School will differ radically from that now in effect in other forest schools in America. The usual plan consists in giving freshmen and sophomore students thorough knowledge of the fundamental sciences underlying the science of forestry and then to build forestry knowledge on that foundation in the junior and senior years. The plan in effect in the Pennsylvania State Forest School will delay the study of most fundamental sciences until the students have an intimate knowledge of the forest.

The freshman year at Mont Alto will be for the study of the forest at first hand. Students will spend fully half their time in intimate contact with the woods. The freshmen students will spend one day each week and the ranger students two days each week engaging in all the activities of the Mont Alto state forest and forest nursery under the direction of a forest ranger. They will learn how to lay out, construct, and maintain forest roads, trails, and fire lines, how to thin growing stands of timber and weed out undesirable species, how seedlings are grown in the nursery, how to reforest denuded and idle land, and how to manufacture forest products in portable sawmills. One day a week will be spent in the study of the trees, shrubs, and the flowers of the forests. They will become acquainted with the birds and animals and the fish in the streams, and study methods of propagation and protection. They will learn at first hand the uses of forests for many purposes. They will learn how to survey tracts of timber and re-run old boundary lines with the compass. They will comprise the forest fire fighting force for the forests of the region and will learn in the woods methods of forest fire protection and suppression. In addition they will spend one day each week in the woods in studying the life of the forest in all its phases and methods of estimating timber.

The object of this instruction is to make these students woods-wise and woods-minded and proficient in woods work, and to carry them as far as possible in the knowledge of forestry. Botany will be studied by the students as a basis for their field work and mathematics as a foundation for surveying.

The sophomore year at State College will be devoted largely to securing such knowledge of fundamental sciences as will enable a proper understanding of

the fundamental principles of forest growth. Sophomore students will study chemistry, physics, botany, geology, soils, surveying, English, etc. At the end of the sophomore year, the students will again be taken to the woods for eight weeks in a different part of the State of Pennsylvania. Half of their time will be spent in practical application of principles of topographic surveying studied throughout the year, the remaining half to a study of logging and lumber operations and wood-using industries, to timber estimating, and especially to silvicultural studies. With their knowledge of fundamental sciences and silvics, these students should have a different conception of the forest than during the freshman year, and should be able to appreciate the causes and effects of forest growth and tree distribution.

At the beginning of the junior year, students will elect one of four lines of study—professional forestry, lumber industry, wood utilization, or private forestry. High-standing students who show a natural inclination for some particular phase of forestry will in addition to their forestry subjects be allowed to elect courses fundamental to future specialization. In this way the foundation can be obtained for future graduate study in forest research, forest soils, forest entomology, forest pathology, range management, forest economics, etc.

Senior foresters will finish their studies at State College by April and will then return to Mont Alto to make a working plan. This will bring together all the knowledge acquired by the students and apply it to a specific tract of timber. The students will make a complete topographic survey of the tract, a type map, a protection map, and a management map. This will necessitate estimating the timber and determining growth and yield. On the basis of the information obtained, plans will be developed for placing the timber on a basis of sustained yield so as to secure continuous revenue from the forest. Two months will be devoted to this study by the entire class.

It is believed that this method of training freshmen and sophomore forestry students will enable a deeper understanding of the technical courses in forestry studied during the junior and senior years and will result in professional foresters better able to apply the art of forestry in the woods.

J. A. Ferguson.

Twentieth Pacific Logging Congress

The twentieth session of the Pacific Logging Congress was held at Seattle, Washington, October 23-26, 1929. For practical usefulness to those who attended and to the logging industry in general, this session of the Congress surpasses its predecessors; from a social standpoint it was no less successful or complete than those of pre-Volstead days. The Pacific Logging Congress, now twenty years old, is undoubtedly a fixture and an important institution in the logging world. Starting out as practically a one-man organization—that man, George M. Cornwall, having at first to supply not only ideas but to work up their presentation as well—the Congress is now managed by a group of young men of virility, intelligence, and leadership, with its founder, however, still active and watchful that it keeps on developing. Once a year it pulls a large number of loggers out of the recesses of camps and woods; to some

it is the only trip of the year of any consequence away from their work.

In twenty years the Congress has almost completely broken down the distrust of one another among loggers, their tendency to isolate themselves, and the feeling that a meeting for the interchange of ideas can help no one. There is now open discussion of costs and original methods, subjects once considered too sacred to divulge to the nearest neighbors, let alone to a large group. There seems also to be a keen realization that interchanges of ideas and coöperation are fundamental to progress and necessary to elevate logging to a higher engineering and economic plane. The latest session, in the opinion of the writer, makes a very close approach, in character of papers read and accompanying discussion, to the sessions of technical engineering societies. There was distinct evidence that the pressure of mounting costs is compelling improved logging methods, and that loggers are eager to grasp at any new ideas toward this end. Of course there were still a few who considered some of the papers too " highbrow," but the number who cannot or will not grasp even simple technical discussion is on a marked decrease.

This is certainly the age of the young man in the logging world; most of the papers were prepared and read by men of the new order, and the most active and intelligent discussion came from the same group. The Congress annually brings to light active and alert men, and deserves much credit for stirring their ambitions to become leaders. Technically trained men from engineering and forestry colleges were much in evidence, but there was also a good sprinkling of those super-men who had not the advantage of a college training and who yet have become outstanding leaders. That these groups of men will exert a powerful influence for the good of the entire lumber industry is without question.

The program of this session started out with a consideration of " Stumpage —Our Raw Material," under which heading was discussed the inventory of the raw material, its protection, and its perpetuation. From the chair to the floor, volume tables, sustained yield, hygrographs, thermographs, barometers, and forest management technique were discussed as familiarly as were skylines, donkey engines, skidders, and chokers later in the day. Thus the Congress recognized that loggers are also timber owners and, therefore, interested in the future of this resource.

Following this general section came a number of papers concerned with technical phases of logging, such as overhead systems; skidders; loading rigs; the place of gasoline and Diesel-oil engines in logging machinery; the tractor as a log getter; problems in utilization, particularly in relogging for pulpwood and the problems presented by the increasing percentage of hemlock; mechanical felling and bucking; making logging camps safety conscious; contract logging; and others.

On the evening of the first day of the Congress a forestry school dinner was held at which teachers, graduates, and employers exchanged thoughts on the place of the forest school graduate in the logging industry, and how the forestry schools can be of service to the loggers. It was evident that a friendly feeling exists toward the schools and their graduates and that there is a recognition that the increasingly difficult problems of logging require skill based on technical

training, but that such training must be supplemented by practical experience.

EMANUEL FRITZ.

A Survey of Animal Problems in National Parks

A survey of animal problems in National Parks was undertaken at the invitation of Horace M. Albright, Director of the National Park Service, on July 1, 1929, by Joseph Dixon and George M. Wright. The object is to analyze these problems and to seek means whereby they may be solved. Certain outstanding problems, such as the bear and deer problems in Sequoia and Yosemite National Parks, the elk problem in Yellowstone and Yosemite, and the mountain sheep, caribou, wolf, and coyote problems in Mount McKinley will be given major attention at the start.

The relation of predatory animals to other members of the fauna of the parks will be given particular attention by Mr. Dixon. Since both of the investigators are members of the committee on economic mammalogy of the American Society of Mammalogists and are much concerned regarding this relation, special emphasis will be placed on this phase of the work.

Mr. Wright, a graduate of the Division of Forestry of the University of California, is keenly interested in the ecology of plant life in the parks. As an illustration of one of the problems in this line, may be cited the fact that in several well-known instances in Yosemite the meadows are being encroached upon extensively by a vigorous growth of young yellow pines with consequent changes in the animal life of the meadows.

Problems arising through the increasing human occupancy of the National Parks and the resultant effect upon the native fauna and flora will also be studied.

This investigation is made possible through the generosity of Mr. Wright, who has assumed the financial responsibility for the project and who, in order to insure its successful completion, has created an independent trust fund under which the work will be carried out. Headquarters and office for the survey will be maintained at Berkeley, California.

Mr. Wright retains his connection with the National Park Service and is to be its representative in all official matters, with the title of Scientific Aid in Investigation. Mr. Dixon retains his title and position as Economic Mammalogist in the Museum of Vertebrate Zoology, University of California. Both Mr. Dixon and Mr. Wright expect to concentrate their energies upon the objectives above outlined, and have therefore been granted freedom from their routine duties in the University and in the National Park Service.

It is planned that facts and conditions as found by personal contact with the living animals in their natural habitats in the parks will be illustrated by a series of both still and motion pictures. Specimens of plants and animals will be collected to insure identification in doubtful cases. It is hoped that the facts thus ascertained will also be useful in the general program for increased activity in the educational work and in the management of animal life in the various national parks.

Full presentation of facts as found, together with recommendations for administrative action, as the work pro-

gresses, has been asked for by Director Albright, to whom the investigators will report directly. A concluding general report, based upon the two years' study, is planned.

White Spruce for Patterns?

In the Journal of Forestry for April, 1929, under title of "Button, Button, Who's Got the Button?" Wm. J. O'Neil laments that "no forester's voice has been raised in protest" against the destruction of valuable pattern and flask lumber in northern Minnesota. He refers to the pulping of white spruce, which he considers a waste of "priceless pattern stock for future generations." Of the spruces he considers that "the white spruce of the Lake States and Canada is not only the best pulp species but likewise makes the best pattern and flask lumber."

White spruce is certainly an outstanding pulpwood, but very few lumbermen or patternmakers will agree that it makes the best pattern wood. An ideal pattern wood must be not only easy to work and keep its shape well, but it must be available in sizes, thicknesses, and grades that permit of a goodly percentage of clear cuttings. White spruce does not attain large sizes in reasonable periods; furthermore, it cannot compare with any of the commercial true white pines as to easy workability. Patternmakers for generations have thought and still think in terms of northern white pine, *Pinus strobus*. Any salesman who ever tried to introduce Idaho white pine, sugar pine, or any other wood found this out very quickly to his dismay. The supplies of these two western true white pines from virgin stands, of redwood, another locally popular pattern wood, and of several other western woods suitable for patterns, are still so great that no patternmaker need worry for over fifty years; furthemore, second-growth pine also produces excellent pattern wood.

So why should any forester object to the use of baby white spruce for pulpwood? Certainly, the author does not mean to imply that the pulping of 6-inch spruce is a waste. Would that all species could and would be used for pulp to such small diameters! There is no danger that future generations will have to import their pattern and flask lumber. Patternmaking today is not the art it once was. Modern woodworking equipment has so eased the labor in making patterns and core boxes that woods other than the standard pines can be used provided they are of the kind that keep their shape well. And as to flask lumber, even white fir has become desirable. Let's be satisfied to have white spruce go into the digesters—as long as we need it for pulpwood it will not pay to hold it to reach sizes suitable for pattern lumber in competition with the superior pines, virgin or second-growth.

Emanuel Fritz.

The Enrollment in Forest Schools of the United States and Canada

In his thought-providing article "Recruiting Lumbermen" (Journal Forestry, May, 1929) Fritz observes: "It is fortunate that many more do not elect to enter a forestry school with the intention of eventually going into purely forestry work, because that field at present is not big enough for a large number of graduates."

This is a plain statement of fact and bears a definite relation to the problem of training men at forest schools, now being studied by the Forest Education Inquiry. The following enrollment figures for 29 forest schools in the United States and Canada indicate how strongly the tide is setting towards forest schools and, in consequence, how critical the situation is:

Year	No. of students
1917	620
1921	1365
1926	2121
1928	2427

And the end is not yet! The vital question is: *for what are we training these men?* When that question is answered then we can determine whether or not we are training them satisfactorily.

In the following tabulation showing the enrollment in 1928 by institutions it should be borne in mind that the figures are not always on a comparable basis since most of the schools include all students from freshman year on while a few include only upper classmen or those who have already received a bachelor's degree:

No. of students	Institution
378	New York State College of Forestry
185	Oregon State College
183	University of Minnesota
161	University of Washington
125	Iowa State College
118	University of Maine
101	Cornell University
100	Colorado Agricultural College
100	Michigan State College
100	University of Montana
91	University of Idaho
88	Pennsylvania State College [1]
80	Pennsylvania State Forest Academy [1]
66	University of California
66	University of Toronto
58	University of New Brunswick
50	Louisiana State College
50	Purdue University
47	Yale University
44	La Val University
40	University of Michigan
40	Utah Agricultural College
39	Georgia State College of Agriculture
35	State College of Washington
30	University of New Hampshire
25	Connecticut Agricultural College
13	Colorado College
8	University of British Columbia
6	Harvard University
2427	

A. B. Recknagel.

University of Washington Receives Forestry Gift

Mrs. Agnes H. Anderson, who in 1924 erected Anderson Hall on the University of Washington campus in memory of her husband, the late Alfred H. Anderson, has made another gift of $50,000 to the University to be known as the Agnes Healy Anderson Trust Fund. The income from this will be used chiefly for graduate research fellowships, with a limited amount for loans to needy students. The purpose of the gift is twofold: to stimulate research at the College of Forestry, and to encourage students in forestry who have shown a special aptitude for research to continue in advanced training.

[1] Combined into one school in 1929.

Mrs. Anderson has long been interested in lumbering and forestry problems. Her father was a prominent lumberman in Wisconsin and later organized several large timber companies in the State of Washington. He was a member of the Washington Legislature and was influential in obtaining for the University its present campus. Mrs. Anderson has always shown a keen interest in the development of forestry and has been an inspiration to both students and faculty of the College of Forestry through her generosity and interest in the development of the work.

John A. Thayer

John A. Thayer, Junior Forester in the U. S. Forest Service and a Junior Member of the Society of American Foresters, died on October 16 as the result of an encounter with a brown bear. He had been cruising pulp timber all summer and was working the southeastern part of Admiralty Island, just south of Juneau, when the tragedy occurred.

Joining the Forest Service in 1921, Thayer had served in Alaska since 1923 with the exception of some two years spent in study at the University of Montana and Oregon Agricultural College. Strong, rugged, skillful, popular, with a keen mind and a love for his work, he will be missed by a host of friends both in the States and in Alaska.

R. F. Taylor.

Errata

In the article on " National and State Forests " in the Journal of Forestry for October, 1929, the reply to the questionnaire from Delaware should be credited to W. S. Taber, State Forester, and not to Willard Springer, Jr., Member State Board of Forestry.

The last two paragraphs on page 630 of this article should be changed to read:

" Five states, including Alabama, still confine their acquisition program to forests for demonstration and research.

" Fourteen states do not desire state forests. Missouri does not want demonstration forests, but gives demonstration uses as the only reason for acquiring them. . . . . "

The ownership of as much as 1 per cent of forest land, or 230,000 acres in Alabama, for demonstration and research is not inconsistent with the state forester's rejection of state ownership for economic purposes of timber production. Alabama should, as indicated in the original article, be classed with the other four states which do not recognize a policy of state ownership for timber production as a business enterprise.

H. H. Chapman.

In the second column on page 841, in the article entitled " Forest Fires in Central Massachusetts," in the Journal of Forestry for November, 1929, the figure 108 in the sixth line should be 128; and the figure 55 in the thirty-second line should be 26.

P. W. Stickel.

In the second column on page 821 in the article entitled " A New Menace to Scotch and Jack Pine," in the Journal of Forestry for November, 1929, the words, " the mature males " in the last sentence should read, " they; "; and in the first column on page 822 the words " they " in the first sentence should read, " the mature males."

L. W. Orr.

SOCIETY AFFAIRS

Franklin Moon

In the death of Franklin Moon the profession of forestry has lost one of its strongest leaders. He was a conspicuous figure in American forestry, standing in the forefront of the movement, contributing from his experience and wealth of constructive ideas, and actively participating in many undertakings of a practical character.

Moon was first of all an educator. For about ten years he carried the heavy burden of the Deanship of the New York State College of Forestry. His work in developing that institution will be a great monument to his ability. He was a sound thinker in education. He was able to secure a large support for his school and he directed its affairs with extraordinary skill. He was successful in bringing the school into very close relation to Syracuse University with which it is affiliated, and in securing in the academic community hearty sympathy and respect for himself, for the school, and for forestry.

Moon's service and influence, however, were not confined to the work of educating men for the work of forestry. He was a leader in the movement of forestry in his state and in the nation. He was a power in the development of policies in New York State. He was a teacher of the people in forest matters, using every intrumentality at his command to create a more intelligent knowledge of forestry among the general public.

His ideas of the mission of forestry were very broad. He perceived that the task of the forester comprehends not only the production of timber, but all activities essential in making the forest and its products of service in the economy of the nation. He applied this principle, so far as it was possible and appropriate, in his educational work, and he was influential in broadening the viewpoint of many foresters with respect to the responsibilities and opportunities of the profession.

He was an idealist, maintaining his faith and optimism in forestry and ever inspiring those with whom he came in contact to the highest aspirations in professional endeavor.

Frank Moon was greatly admired and beloved for his personal qualities. In his dealings with others he was always considerate, open-minded, and loyal. He had the interests of his associates at heart and commanded their full confidence. He was a man of wide reading and culture and an interesting and charming companion. Frank Moon's name is secure in history. He has left a memory of singular personal affection and regard among those whose lives were enriched by their association with him.

Henry S. Graves,
Nelson C. Brown,
Paul G. Redington,
Committee for the Society.

Cut off in the prime of his usefulness, the loss of Dean Franklin Moon by death on September 3, 1929, at the age of forty-nine years, will be felt in forestry circles in two continents. He enjoyed a wide acquaintance in both Europe and America and is deeply mourned by a great host of warm friends. The students who have gone out from the New York State College of Forestry and who came under his friendly and inspiring tutalage are distributed throughout the world.

At twenty-one he was graduated from Amherst with the degree of Bachelor of Arts. He did two years postgraduate work at Harvard from 1902 to 1904, and subsequently attended the Yale University Forestry School, there receiving the degree of Master of Forestry in 1909.

Dean Moon then began at the age of twenty-nine a period of twenty years of public service extending to the present. He belonged to the second generation of foresters as differentiated from the patriarch founders of the profession in this country. Fernow, Roth, Pinchot, Roosevelt, Graves, Schenck, and their contemporaries represent the pioneers of the forestry movement but Dean Moon, entering the profession in a later era, was no less a crusader for the profession—a "defender of the Faith." His early activities in forestry lapped over into that period in which most of the work was accomplished in laying the foundations for the National Forests and creating public regard for forest conservation.

Dean Moon's career as a practical forester, before he entered scholastic work, was eminently successful. He made reconnaissance studies for the State of Connecticut in 1908, was with the U. S. Forest Service in Kentucky in 1909, and notably in New York in 1910-11. After a year at the Massachusetts Agricultural College, he began teaching forest engineering at Syracuse in 1912 and pursued this vocation eight years.

Dean Moon's reputation as an educator and leader in forestry, however, began to assume significant proportions when he became dean of the New York State College of Forestry in 1920, following the resignition of Dean Hugh P. Baker.

This occurred at the time the economic side of forestry began to take on large proportions. He believed in vigorous, progressive leadership and a broad interpretation of forestry based upon public welfare. At the same time he advocated the application of forest technique to industrial problems. The emphasis placed on the sciences in the instructional field at Syracuse and his writings are evidence of this tendency. He was a keen observer of the progress of events and never hesitated to take a forward step whenever such action seemed prophetic of future requirements. He organized his forces at the College under a plan that made for efficiency and aggressiveness. He had an unfailing faith in the destiny of the profession and was always urging an idealistic conception upon the student body as a basis of their training.

Dean Moon was a careful, thoughtful, constructive executive. His plans were forward-looking and when once formulated were pursued with untiring energy. During his nine years as dean, the good reputation of the college increased and the growth of its physical properties went on apace. He was greatly interested in reforestation and was one of the prime movers in urging the measures which eventually became the Hewitt Laws, providing for state-wide reforestation and the reclamation of idle forest land in

the state. His wide-awake personality and kindly disposition, coupled with a sense of good humour, won him friends and kept him in the van of progress. He spent a great deal of time with the alumni and never failed to give advice or devote sufficient time to help them with their problems. He was a champion of professional ethics and believed in a united front in the profession in relation to forestry problems.

His constructive accomplishments are well illustrated in the completion of the new Ranger School headquarters on the shores of Cranberry Lake in the Adirondacks. This building, dedicated in 1928, was an achievement covering a period of labor almost from the beginning of Dean Moon's administration. The establishment of the Charles Lathrop Pack Demonstration Forest near Warrensburgh, N. Y., was another milestone in the development at Syracuse. This greatly diversified "show-window" forest is something new in the scheme of public demonstration and education in forestry. The acquisition of 1000 acres of land located on Cranberry Lake, seven miles from the Ranger School forest, was another administrative stroke of great advantage to the teaching staff of the college. On this area is located the Sophomore Summer Camp. The tract offers a wide variety of forestry conditions for the instruction of students. Dean Moon's plans for the future were as far-reaching as his accomplishments of the past. He was just beginning to realize the development of the college, as he visualized it, when his career was ended.

In 1926 he was one of the American Delegation at the International Congress of Forestry at Rome, and recently has served as chairman of the Committee on International Relations of the Society of American Foresters, and as a member of the Research Council of the Northeastern Forest Experiment Station. He was also chairman of the New York Section of the Society of American Foresters.

He was the author of the "Book of Forestry," he was co-author in writing "Elements of Forestry," and with H. C. Belyea he wrote the bulletin "Forestry for the Private Owner." He wrote an extended report on the survey of the forestry situation in Europe. He was a large contributor to magazines and news articles for popular reading as well as the author of numerous technical bulletins.

He was born July 3, 1880, at Easton, Pa., the son of William White Moon and Ophelia Frances Nightingale Moon. He is survived by Mrs. Moon, formerly Miss Marion Stutson of Columbus, Ohio, and their son Frederick Franklin Moon, Jr., 612 Ostrom Avenue, Syracuse.

Nelson C. Brown.

Council Holds Formal Meeting

A formal meeting of the Council at the Society Office on November 8, attended by Redington, Preston, Sparhawk, Stuart, Butler, Chandler, and Marsh, transacted a considerable volume of business.

Among the things of special interest to the Society taken up at the meeting was the paid-secretary project. It was reported that current revenues were estimated to be exceeding expenditures by $4000 or more. This is considerably more than was thought possible at the

beginning of the year, and is the result, among other things, of the increase in dues and the growing membership. The subscription campaign, still not quite completed, had brought in subscriptions in excess of $4000 annually. With these items and the reserve fund to fall back upon if necessary, in a limited way, the success of the financing was clearly assured. It will be recalled that an annual sum of $10,000 for three years was estimated to be needed to put the project on a sound basis.

The meeting considered the specific qualifications desirable for the position, and discussed possible candidates. The qualifications were briefly listed as: Good forestry training; vision, leadership, and creative ability; executive capacity; a personality suited to making effectively the many needed contacts; varied and broad experience; and familiarity with the history and development of the Society. The last two were considered as not absolutely necessary but desirable. Steps are being taken toward the selection and employment of a man.

Several points about the duties of the office were discussed, which had been brought up by correspondence or otherwise. Among these was the question of whether or not the executive secretary should be precluded from any activity in connection with legislative matters. It was concluded that it would be unwise to adopt any such blanket rule, insofar as legislative and policy questions of national importance were concerned, but that in connection with these the secretary's action would be guided by the Council and the Executive Committee thereof. The general policy on this was sufficiently well enunciated for present purposes in the formal statement by the Executive Council, dated June 10, 1925, and published in the January, 1926, issue of the JOURNAL (page 85). This statement covers in a general way the objectives and scope of the activities for the secretary.

The consideration of a set of by-laws, upon which Sparhawk had done most of the work, made necessary by the new constitution, was brought to a conclusion and the by-laws adopted. There are 75 of these by-laws, and they make a valuable supplement to the constitution.

Reference was had to correspondence with the Camp Fire Club of America with regard to a set of National Park standards, the Society's endorsement of which, along with others, had been solicited. The idea behind the efforts of the Camp Fire Club seemed wholly commendable, but there appeared to be some possibility of unwise duplication of effort by different agencies in promulgating adequate standards and, further, certain points in the proposed standards were subject to question. The decision of the Council was postponed pending further information.

It was decided that the President should write President Hoover, commending the appointment of a commission to study the public domain problem and the placing thereon of an outstanding forester.

It was reported that some progress was being made, in which the American Engineering Council has been helpful, toward securing more adequate recognition of the forestry phase of the Mississippi flood problem, in connection with the work of the Mississippi River Commission.

The Council authorized the organization of the Ozark Section, to include the States of Missouri, Kansas, Oklahoma, Arkansas, and western Tennessee.

Announcement was made that the Society membership lists, to be issued in pamphlet form to all members, were in the hands of the printer. A second pamphlet, to include the constitution and by-laws, will be issued at an early date.

R. E. Marsh,
Secretary.

Progress of the Forest Education Inquiry

The work of the Forest Education Inquiry was brought into full swing on July 1, 1929, when the grant of $30,000 from the Carnegie Corporation was received. Prior to that time the committee of the Society was occupied in planning the organization of the work, selecting the personnel of the staff, and in various other ways preparing the way for the investigation.

In July a printed circular was distributed among the membership of the Society and elsewhere, describing the objectives and scope of the Inquiry and the general plan of procedure. There was included also a statement regarding the organization of the work, with the names of the executive staff and of the coöperating committee representing the Society. The direction of the Inquiry has been delegated to Dean Graves. The Assistant Director, who will carry the chief burden of the field investigation, is Professor C. H. Guise of Cornell. The Inquiry is fortunate in being able to secure as consulting members of the executive staff Dr. George A. Works, President of the Connecticut Agricultural College, and Professor E. J. Kraus, Professor of Botany in the University of Chicago.

The essential information regarding the profession of forestry and its needs from an educational standpoint and regarding the existing system of education will be assembled partly through questionnaires and partly through personal conferences with educators, employers, practicing foresters, and others. A questionnaire has already been sent to about 6000 former students of the forest schools. The response is excellent.

Mr. Guise is now in the Northwest, visiting the forest schools and securing information also through various other sources regarding the many questions involved. Meantime a variety of educational problems are under study by the Director and Dr. Works and Dr. Kraus. It is expected that a number of eastern institutions will be visited by them, with a view to defining and clarifying certain features of the Inquiry.

The officers of the Inquiry will welcome correspondence with any interested persons who may have questions to ask or comments to make regarding the undertaking.

The headquarters of the Inquiry are at 215 Church Street, New Haven, Connecticut.

Henry S. Graves.

Washington Section Considers Public Domain Problem

At the meeting of the Washington Section on October 24, 1929, Representative Burton L. French, member of Congress from Idaho, explained the bill

(H. R. 4187) which he introduced on September 23, 1929. The object of this bill is to protect the public domain from deterioration through erosion, to foster its highest use in the conservation of water, to encourage the growth of timber and forage plants, and to stabilize the livestock industry in so far as it depends upon the public range. Administration of the public domain for these purposes would be handled by the Secretary of the Interior in accordance with detailed provisions contained in the bill. This plan is directly opposed to the President's tentative suggestion that it would be well to turn over to the states surface rights to the unreserved public lands.

In commenting on the French Bill Dr. Wilbur, the Secretary of the Interior, said that the bill lacked "teeth" and teeth meant money. To properly administer and police the extensive public domain would require a large annual appropriation which Mr. French had not provided for in his bill. The Secretary said that the President's proposal was based on the record of the past 25 years' administration of the public domain by the federal government and the belief that the states could hardly do worse. He further stated that when the situation is fully realized the people needing watershed protection and better grazing land will solve the problem themselves. The majority rules and the majority in the West lives in towns and valleys where dependence is placed on water obtained mostly from mountain watersheds. To further illustrate his point he cited the early conflict between the farmers and miners in the Sacramento Valley of California. The farmers needed all the water and being in majority drove the placer miners out of the valley. Dr. Wilbur emphasized the fact that his main interest is in obtaining effective administration of the public lands, irrespective of the agency by which this is done, and that he had tried to present the problem in such a way as to force a decision.

The Assistant Secretary of the Interior, Joseph M. Dixon, speaking for himself only, said that if he were a Mussolini he would like to try out one of the following alternatives: First, he would put the national forests back in the Interior Department where they belong, would repeal the legislation requiring congressional action in order to change the boundaries of national forests in certain of the western states, and would then add the remaining unreserved public domain to the national forests. Second, he would give all the public domain to the states with the proviso that the land be sold to private interests at a fixed price per acre, say 50 cents, and that the receipts be used for the public schools and the maintenance of public roads. As a means of self-preservation the stockmen would take steps to protect and improve the land thus acquired.

Representative Smith of Idaho said that the hostility which existed toward the Forest Service in its earlier days has very largely disappeared and that legislation should be obtained to permit the President to add to the national forests whenever it appeared advisable to do so. In the past many attempts to enlarge the national forests by adding public domain lands have been frustrated by adverse reports from the Secretary of the Interior on bills sponsored by the Secretary of Agriculture. Congressman Smith believes that much could be accomplished if the President's Cabinet would get together on the public domain problem.

He spoke also of the amount of silt that is flowing into irrigation project dams and filling them up, and of the rapid water run-off which in several parts of the West has been advanced from 14 to 18 days.

Representative Colton of Utah drew attention to the unsatisfactory condition of the public domain where large areas once covered with good forage are now nothing more than dust beds. Areas which once supported bands of sheep for days at one camp setting now hardly have sufficient feed for a band of sheep for one day. The state of Utah will accept the public lands if the federal government will first restore them to their former value for grazing and watershed purposes. Mr. Colton cannot see any objection to giving the states the mineral resources along with the surface rights. He sees no good objection to putting the public domain into national forests, and as chairman of the House Committee on Public Lands he expects to take up this important problem at an early date.

Senator Nye of North Dakota stated that he had not given the public domain problem sufficient study to reach a decision but has an open mind and believes that the matter should be suitably adjusted between the states and the federal government. As chairman of the Senate Committee on Public Lands he too expects to take up the problem at an early date.

Mr. Munns questioned the soundness of the President's and Dr. Wilbur's proposal to turn over the public lands to the states on the theory that the states will take better care of the land, and cited examples to show that California has done as badly as the federal government, or even worse, with its state forest and watershed areas. If past history of state administration is any criterion of the future, he believes that the argument is settled in favor of federal control.

A Forest Service motion picture illustrating selective logging in the Lake States was shown, after which the meeting adjourned to a sumptuous supply of doughnuts, fruit salad, and lemonade. About 80 members and friends of the Society of American Foresters attended the three-hour meeting, which was attended by a number of distinguished men in addition to those who spoke.

E. Morgan Pryse,
Secretary-Treasurer.

Ohio Valley Section Explores Southern Illinois

The seventh annual meeting of the Ohio Valley Section of the Society was held in Southern Illinois, October 24-26, 1929. Ohio was agreed upon as the place of next year's meeting, and the following officers were elected:

E. F. McCarthy, Chairman,

F. W. Dean, Secretary-Treasurer,

N. W. Scherer, Member of Executive Committee.

The trip, as planned by the foresters of the State Department of Conservation, allowed for two business meetings, at Centralia and at Anna. At the evening meeting at Centralia on October 24, E. F. McCarthy, Director of the Central States Forest Experiment Station, introduced the subject of erosion, precipitating a discussion as to whether the forester should confine his attention to the worst

eroded lands or should study also lands which the soil expert claims can be prevented from eroding by fertilization, addition of humus, and other methods. It was finally agreed that the latter lands constitute a problem in connection with forest planting and that a further study, both quantitative and qualitative, should be made to assist in a satisfactory classification of eroded land.

Mr. McCarthy also presented the matter of forest planting and at the end of the discussion it was deemed advisable that a committee be appointed to advise regarding a planting program. It was hoped that such progress could be made in a few years that species for the various soil types could be prescribed in the office without additional field examination of planting sites, although Dr. Baxter interjected the thought that to avoid mistakes these sites should be carefully examined from both the silvicultural and the biological standpoints. It was also decided that a committee of three should be appointed to work with the Central States Forest Experiment Station in making a type classification for the region.

The points of interest and discussion for October 25 were the tight clay lands of Perry County, known as "the post oak flats"; the strip mine operations of the Perfection Coal Company at DuQuoin, where there was an opportunity to see the gigantic steam shovels in operation and lands which had been stripped as early as 1918, with their various stages of succession; and the tract of 3279 acres of upland timber recently purchased as a state forest in Union County which is also to be posted as a state game refuge.

The first part of the evening meeting at Anna on October 25 was a joint one with the Anna-Jonesboro Rotary Club addressed by Mr. McCarthy, after which the foresters transacted a great deal of business. The resolutions adopted stressed the need of better utilization and marketing studies for farm woodlot products, the development of a planting policy for the states covered by the Section, further study of eroded lands, and establishment of state nurseries in those states where none existed.

On October 26 the party proceeded south towards Cairo, spending a few hours at Horse Shoe Lake, where the state has 3100 acres of farming land, water, and swamps, the latter containing cypress and tupelo gum timber. Cypress is getting scarce in that region so that this remnant of original conditions will have increasing value to ecologists and foresters. Members of the party were impressed with the great number of species on the island, the center of which is very fine farming land and can be devoted to farm crops and raising food for geese and ducks.

After lunch the members separated, returning to their homes by various routes, satisfied that there was much still to be seen in southern Illinois, from the Ozarks to the cypress and tupelo gum country north of Cairo. An invitation was extended to all to come again, make a longer stay in Illinois, enjoy her beauties, and contribute new ideas for her advancement in forestry.

R. B. Miller,
Secretary-Treasurer.

Announcement of Candidates for Membership

The following names of candidates for membership are referred to Junior Members, Senior Members, and Fellows for comment or protest. The list includes all nominations received since the publication of the list in the November Journal, without question as to eligibility; the names have not been passed upon by the Council. Important information regarding the qualifications of any candidate, which will enable the Council to take final action with a knowledge of essential facts, should be submitted to the undersigned before February 28, 1930. Statements on different men should be submitted on different sheets. Communications relating to candidates are considered by the Council as strictly confidential.

FOR ELECTION TO GRADE OF JUNIOR MEMBER

Name and Education	*Title and Address*	*Proposed by*
Adams, Gifford Belcher Univ. of Me., B. S. F.; Yale, M. F., 1929	Assistant Forester, St. Lawrence Paper Mills Co., Ltd., Three Rivers, P. Q., Canada.	R. C. Hawley R. C. Bryant H. H. Chapman
Adams, Sherman Dartmouth, A. B., 1920	Manager, Timberland Dept., Parker-Young Co., Lincoln, N. H.	New England Sec.
Ashman, Robert I. Cornell, B. A., 1913; Yale, M. F., 1929	Employee, Great Northern Paper Co., Forestry Dept., Augusta, Me.	New England Sec.
Carlson, Floyd E. Univ. of Wash., B. S. F., 1928	Scaler, U. S. Forest Service, Ketchikan, Alaska.	North Pacific Sec.
Dexter, Albert Kendall Univ. of Wisc., 2 yrs.; Univ. of Mont., B. S. F.	Manager, Perrin-Curtin Lbr. Corp., Kosciusko, Miss.	Gulf States Sec.
Gustafson, Rudolph O. Univ. of Wash., B. S. F., 1928; Yale, M. F., 1929	Logging Engineer, Charles R. McCormick Lbr. Co., Seattle, Wash.	North Pacific Sec.
Hursh, Charles R. Oreg. Agric., 1918; Wash. Univ., 1920; Pasteur Inst., Paris, 1924-5; Univ. of Mo., B. S., 1917; Univ. of Minn., Ph. D., 1923	Associate forest ecologist, Appalachian Forest Exp. Sta., Asheville, N. C.	Appalachian Sec.
Jackson, Wilfred West Va., B. S. A.; Mich. State, B. S. F., 1929	Forester, Cherry River Boom and Lbr. Co., Richwood, W. Va.	Allegheny Sec.
Kirkpatrick, Dahl J. Univ. of Wash., B. S. F., 1929	Protective Ass't, Randle, Wash.	North Pacific Sec.
Liefeld, Theodore A. Mich. State, B. S. F., 1929	Research Ass't in Forestry Dept., Pa. State College, State College, Pa.	Allegheny Sec.
Manges, Daniel Edmund Gettysburg, B. A., 1926; Yale, M. F., 1929	Member of staff, Creosoting Div., Long-Bell Lbr. Co., DeRidder, La.	Gulf States Sec.
Perkins, Carlton L. Univ, of Me., B. S. F., 1918	Supervisor, Monongahela N. F., Elkins, W. Va.	Allegheny Sec.

Name and Education	*Title and Address*	*Proposed by*
White, Wallace Earl Univ. of Vt., B. S., 1925, M. S., 1926; Yale, Ph. D., 1929	Instructor in Botany, Pa. State School of Forestry, Mont Alto, Pa.	Allegheny Sec.
Wilkins, Austin H. Univ. of Me., B. S. F., 1926; Cornell, M. F., 1928	Ass't Field Forester, Maine Forest Service, Augusta, Me.	New England Sec.
Williamson, Francis E., Jr. Forestry, Univ. of Mont., 3½ yrs., 1923; no degree	Senior Forest Ranger, U. S. Forest Service, Rhododendron, Ore.	North Pacific Sec.

FOR ELECTION TO GRADE OF SENIOR MEMBER

Canterbury, Nathan D. Yale, M. F., 1922 (Junior Member 1924)	Acting Supt. of Forestry, New Orleans, La.	W. R. Hine H. H. Chapman R. C. Hawley Gulf State Sec.
Clepper, Henry E. Penn. State, B. F., 1921 (Junior Member 1923)	Forester in charge of Special Research Studies and Blister Rust Control in Pa., Brockway, Pa.	Allegheny Sec.
Dewald, F. I. Penn. State, B. S. F., 1919 (Junior Member 1923)	Senior Forester, Stokes State Forest, Branchville, N. J.	Allegheny Sec.
Kessler, Nelson T. Penn. State, B. S. F., 1922 (Junior Member 1924)	Senior Assistant Forester, Dept. of Conservation and Development, Trenton, N. J.	Allegheny Sec.
Lutz, H. J. Mich. State, B. S., 1924; Yale, M. F., 1927 (Junior Member 1925)	Associate Silviculturalist, Allegheny Forest Exp. Sta., Philadelphia, Pa.	Allegheny Sec.
Moore, E. B. Oreg. State, B. S. A., 1923 (Junior Member 1927)	Senior Forester, Dept. of Conservation & Development, Trenton, N. J.	Allegheny Sec.
Myers, R. V. Biltmore Forest, B. F., 1911; F. E., 1914 (Junior Member 1927)	Manager, Timber Dept., New River & Pocahontas Consolidated Coal Co., Berwind, W. Va.	Allegheny Sec.
Nicholas, Herbert M. Penn. State, B. S. F., 1921 (Junior Member 1923)	District Forester, Scranton, Pa.	Allegheny Sec.
Roberts, B. L. Univ. of Me., B. S. F., 1909 (Junior Member 1925)	Chief Forester, Cherry River Boom and Lumber Co., Richwood, W. Va.	Allegheny Sec.
Seidel, William J. Univ. of Mich., B. S. F., 1921 (Junior Member 1926)	Acting as Chief Assistant to State Firewarden, Dept. of Conservation & Development, Trenton, N. J.	Allegheny Sec.
Shirey, T. I. Penn. State, B. S. F., 1921 (Junior Member 1924)	District Forester, Gallitzen Forest District, Johnstown, Pa.	Allegheny Sec.

Name and Education	*Title and Address*	*Proposed by*
Shivery, George Burton Penn. State, B. S. A., 1916; Yale, M. F., 1924 (Junior Member 1925)	Extension Forester, Univ. of Tenn., Agricultural Extension Service, Knoxville, Tenn.	Appalachian Sec.
Swingler, W. S. Penn. State, B. F., 1921 (Junior Member 1926)	District Forester, Wyoming Forest District, Bloomsburg, Pa.	Allegheny Sec.
Trenk, Fred B. Iowa State, B. S., 1923; M. F., 1925 (Junior Member 1925)	Assistant Forester, State Dept. of Forestry, Univ. of Md., College Park, Md.	Allegheny Sec.

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Treasurer, W. N. SPARHAWK, Forest Service, Washington, D. C.

Executive Council

The Executive Council consists of the above officers and the following members:

	Term expires		Term expires
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ALDO LEOPOLD	Dec. 31, 1931	W. G. HOWARD	Dec. 31, 1931
T. T. MUNGER	Dec. 31, 1931	OVID M. BUTLER	Dec. 31, 1929

Member in Charge of Admissions

B. A. CHANDLER................Dec. 31, 1929

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Ohio Valley

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Art.—article; ed.—editorial; rev.—review; art. (rev.)—review of article or book by; n.—note; s. a.—society affairs.